From:	Higdon, Penny (DH/MS)
To:	(DH/MS)NB Public Health COVID Response Team
Subject:	FW: COVID-19 Web Posting: Adjusting public health measures in the context of COVID-19 vaccination
Date:	August 13, 2021 5:50:05 PM
Attachments:	FOR SAC FYI_Adjusting PHM Guidance_August 12 2021.pdf
	FOR SAC FYI_Schools Guidance_August 12 2021_002.pdf

FYI

From: Davies, Stephanie (PHAC/ASPC) <stephanie.davies@canada.ca> **On Behalf Of** CCMOH SECRETARIAT / CMHC (PHAC/ASPC)
Sent: August 13, 2021 5:07 PM
To: CCMOH SECRETARIAT / CMHC (PHAC/ASPC) <phac.ccmoh.secretariat-cmhc.aspc@canada.ca>; Amy Riske <Amy.Riske@yukon.ca>; Andrea McKenna <AndreaMcKenna@gov.nl.ca>; Romano, Anna (PHAC/ASPC) <anna.romano@phac-aspc.gc.ca>; Auger, Julie (PHAC/ASPC) <julie.a.auger@phac-aspc.gc.ca>; Avis Gray <avis.gray@gov.mb.ca>; Brent Roussin <brent.roussin@gov.mb.ca>; Catherine Elliott <catherine.elliott@gov.yk.ca>; Colleen Dudar <Colleen.Dudar@gov.mb.ca>; Dr. Barb Yaffe <barbara.yaffe@ontario.ca>; Henry, Bonnie (Ext.) <bonnie.henry@gov.bc.ca>; Emerson, Brian (Ext.) <brian.emerson@gov.bc.ca>; Muecke, Dr. Cristin (DH/MS) <Dr.Cristin.Muecke@gnb.ca>; Dr. Deena Hinshaw <deena.hinshaw@gov.ab.ca>; Adams, Evan (SAC/ISC) <evan.adams@canada.ca>; Dr. George Giovinazzo <george.giovinazzo@cic.gc.ca>; Morrison, Heather (Ext.) <hgmorrison@gov.pe.ca>; Njoo, Howard (PHAC/ASPC) <howard.njoo@phac-aspc.gc.ca>; Dr. James Worthington <dr.james.worthington@csc-scc.gc.ca>; Dr. Janice Fitzgerald <JaniceFitzgerald@gov.nl.ca>; Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>; Dr. Kieran Moore <kieran.moore1@ontario.ca>; Dr. Michael Patterson <mpatterson@gov.nu.ca>; Dr. Robert Strang <robert.strang@novascotia.ca>; Shahab, Saqib (Ext.) <saqib.shahab@health.gov.sk.ca>; Sharma, Supriya (HC/SC) <supriya.sharma@hc-sc.gc.ca>; Tam, Dr Theresa (PHAC/ASPC) <theresa.tam@phac-aspc.gc.ca>; Wong, Tom (SAC/ISC) <tom.wong@canada.ca>; Cleary, Eilish (SAC/ISC) <eilish.cleary@canada.ca>; Ernest Ebert <Ernest.Ebert@forces.gc.ca>; Arruda, Horacio (Ext.) <horacio.arruda@msss.gouv.qc.ca>; Kandola, Kami (Ext.) <kami_kandola@gov.nt.ca>; Reka Gustafson <reka.gustafson@phsa.ca>; Richard Masse <richard.masse@msss.gouv.qc.ca>; Robinson, Kerry (PHAC/ASPC) <kerry.robinson@phac-aspc.gc.ca>; Shannon McDonald <shannon.mcdonald@fnha.ca>; Shelley Deeks <Shelley.Deeks@novascotia.ca>; SK CMOH Single Window <OCMHO@health.gov.sk.ca>; Suzanne Fedorowich <suzanne.fedorowich@health.gov.sk.ca>; Tami Denomie <tami.denomie@health.gov.sk.ca>; Trish Merrithew <Trish.Merrithew-Mercredi@gov.ab.ca>; Vincent Beswick-Escanlar <VINCENT.BESWICK-ESCANLAR@forces.gc.ca>; YK Surveillance <YCDCsurveillance@gov.yk.ca>; Yves Jalbert <yves.jalbert@msss.gouv.qc.ca>
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Subject: FYI: COVID-19 Web Posting: Adjusting public health measures in the context of COVID-19 vaccination

<mark>ATTENTION! External email / courriel externe.</mark>

* *Sent on behalf of* Public Health Measures for COVID-19 Response
****
Dear SAC members,
Further to the email below, we are pleased to inform you that the following document is now LIVE on the web, in both official languages.
Adjusting public health measures in the context of COVID-19 vaccination
EN: https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/guidance-documents/adjusting-public-health-measures-vaccination.html
FR: https://www.canada.ca/fr/sante-publique/services/maladies/2019-nouveau-coronavirus/document-orientation/adaptation-mesures-sante-publique-vaccination.html
Please distribute among your networks as appropriate.
PHM Group

From: Davies, Stephanie (PHAC/ASPC) <stephanie.davies@canada.ca> **On Behalf Of** CCMOH SECRETARIAT / CMHC (PHAC/ASPC)
Sent: 2021-08-13 2:06 PM
Subject: For Information: Updated Adjusting public health measures & Schools guidance with our thanks for your input
Dear SAC members,
Please see the email below, being shared on behalf of the Public Health Measures for COVID-19 Response team at PHAC, thanking you for your review and feedback and providing you with a summary of the revisions that have been made to the attached PHM and schools guidance documents.
Please do not hesitate to reach out should you have any questions.
Kind Regards,
SAC Secretariat

Dear SAC members,

Thank you for your thorough review and feedback on the attached guidance. We have received a great deal of helpful feedback from a variety of groups and have been able to address most feedback in the attached versions, titled:

- *Adjusting public health measures in the context of COVID-19 vaccination* (anticipated posting of TODAY, August 13)

Testing and screening will continue to be important in the ongoing management of COVID-19.

Canada's Expert Panel on Testing and Screening recognizes that 30% to 50% of children with SARS-CoV-2 infection are asymptomatic. The panel encourages screening test strategies where community prevalence suggests it would be beneficial, including through the use of rapid tests to screen for COVID-19 cases as a complement to lab-based PCR testing. Furthermore, self-tests may become available in the near future that offer students, staff and parents the opportunity to conduct testing at home to help identify SARS-CoV-2 infection.

Schools should have communication strategies in place targeting students and staff, as well as parents and guardians to ensure that individuals do not enter the school setting if they are experiencing symptoms compatible with COVID-19 (as defined by the PT), have tested positive for COVID-19, or are otherwise instructed by the regional/local PHA that they must quarantine or isolate. It is also important to consider that other respiratory illnesses (e.g., influenza, RSV) may circulate during the fall and winter. Schools should be aware that there may be mildly symptomatic individuals who test negative for COVID-19 (but may still have another respiratory illness or condition).

For additional information, guidance is available on priority strategies to optimize testing and screening for primary and secondary schools, which provides evidence-informed advice on existing approaches to testing and symptom screening measures to support in-person learning, with recommendations focused primarily on communities with high or increasing community transmission of SARS-CoV-2.

Mask wearing

In some circumstances, regional/local PHAs may recommend, or schools may choose to implement, mask wearing as an additional measure in schools when the local community or school are at higher risk for COVID-19 spread[53].

A well-constructed, well-fitting and properly worn non-medical mask has been shown to protect the wearer and those around them[53, 54, 55, 56, 57, 58, 59]. Mask wearing may also be encouraged when physical distancing is not possible (i.e., indoor public places, crowded outdoor settings, during activities with close contact with

others)[60, 61, 62]. It is important to recognize that some people may choose to wear a mask based on a personal risk-assessment (e.g., those who are at a higher risk of severe disease or outcomes)[63, 64]. It is also important that these individuals are not stigmatized for their choice. Further, school administrators will need to accommodate the needs of students with disabilities and ensure that they have access to the same public health information and, to the extent possible, appropriate mitigation measures (e.g., assistance with mask wearing).

Compared to the potential negative consequences associated with school closures and online learning noted above, mask wearing can prevent SARS-CoV-2 transmission among unvaccinated children[55, 65, 66] and may also help reduce transmission of other respiratory conditions within school settings (e.g., influenza, RSV)[67, 68, 69]. Existing studies show that mask use among children does not significantly impair their physiological health (i.e., respiratory function); however, consistent adult supervision on the correct and safe wearing of masks is strongly encouraged to prevent respiratory impairments[70, 71]. There is no strong evidence suggesting negative consequences of mask wearing in children[70, 72, 73, 74].

Physical distancing and cohorting

In some circumstances, regional/local PHAs may recommend, or schools may choose to implement, physical distancing **Footnote e** as an additional measure when the local community or school are at higher risk for COVID-19 spread. Although physical distancing can reduce the risk of SARS-CoV-2 transmission[75, 76, 77], it can be challenging to implement in school settings where space may be limited and personal interactions are required during the learning processes.

Schools may choose to cohort students, implement distancing between the cohorts, and/or stagger cohort activities if/when a local circumstance warrants physical distancing recommendations, or when advised by the regional/local PHA.

This is why it is important, when directed by the regional/local PHA based on local COVID-19 epidemiology and other indicators, to take a "layered approach" and adhere to other PHMs, such as indoor ventilation, screening and testing measures, and mask wearing to minimize the risk of spreading COVID-19. When regional/local PHAs are determining whether to recommend physical distancing

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: EECD Update- Masking requirement in schools
Date:	September 14, 2021 12:19:54 PM
Attachments:	image001.png
	masks-are-neither-effective-nor-safe.pdf

From: 21(1)

Sent: Tuesday, September 14, 2021 10:15 AM

Subject: FW: EECD Update- Masking requirement in schools

ATTENTION! External email / courriel externe.

Hello,

I am writing you as a concerned parent about the recent update to the masking policy in all New Brunswick schools. Where is the scientific evidence to base those decisions? There are many doctors speaking out about the **harmful** effects of masking. Here are some resources for you in case you are truly not aware.

"On April 8, 2021 a German Court ruled against masks, social distancing, and testing for students. Stating, "the measures now prohibited, represent a present danger to the mental, physical or psychological well-being of the child to such an extent that, if they continue to develop without intervention, considerable harm can be foreseen with a high degree of certainty. The children are physically, psychologically, and pedagogically damaged and their rights are violated without any benefit for the children themselves or third parties." Further, according to the German court's conviction, "school administrators, teachers and others cannot invoke the state-law regulations on which the measures are based, because they are unconstitutional and thus void." Masks are ineffective in protecting against influenza and other aerosol-sized respiratory illnesses. BC Health Officer, Bonnie Henry, attested to this in the 2015 Ontario Nurses Arbitration saying, "there's very scant evidence about the value of masks in preventing the transmission of influenza." Common side-effects of mask wearing include headaches, drowsiness, dizziness, reduced ability to concentrate, and reductions in cognitive function. Also, given that the development of neurodegenerative diseases can take years to manifest, we cannot ignore the potential long-term harms of continual mask usage. The stressful impact of masking also runs the risk of having a damaging and permanent impact on our child's immune system. Additional medical harms caused by masks and hand sanitizers include rash and burning skin irritations. **Children are at nearly zero percent risk of contracting or transmitting the respiratory virus referred to as Covid-19 and have a 99.997% survival rate. Further, schools are reportedly at very low risk for transmission of this virus.**"

https://rumble.com/vhag6d-canadian-doctors-speaking-out-protecting-our-children-from-harm.html

Please feel free to contact me to discuss further.

Thank you,
21(1)

From: Anglophone South School District

Sent: September 13, 2021 6:34 PM

To: 21(1)

Subject: EECD Update- Masking requirement in schools

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Dear ASD-S Families,

Update: Mask use in schools

This evening we are sharing a letter from Deputy Minister of Education and Early Childhood Development George Daley and Dr. Cristin Muecke, Medical Officer of Health, about masking inside of all New Brunswick schools beginning tomorrow.

While there has not been a COVID-19 case in ASD-S yet this school year, positive cases have been confirmed in schools in zones 1 (Moncton region), 3 (Fredericton region) and 5 (Campbellton region). In light of these cases, the province, in consultation with Public Health, has added this extra safety measure across all of the province's school districts. The Department of Education and Early Childhood Development will continue to work with Public Health to adapt guidelines based on new information and we will keep you informed of any new changes.

Our schools are working very hard to keep our schools healthy, safe, and as close to normal as possible for staff and students, particularly those under 12 or those who cannot be immunized. Thank you for your understanding as we work together to follow the safety guidelines provided to us by the Department of Education and Early Childhood Development and Public Health.

If you did not receive this notice via School Messenger email, please ensure your contact information is up to date at your child's school.

[Letter re: Mask Update](#)

Zoë Watson,

Superintendent ASD-S

Masks Are Neither Effective nor Safe
The Scientific Literature

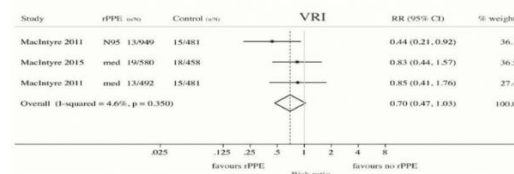1. T Jefferson, M Jones, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. MedRxiv. 2020 Apr 7. ~~ https://www.medrxiv.org/content/10.1101/2020.03.30.20047217v2

2. J Xiao, E Shiu, et al. Nonpharmaceutical measures for pandemic influenza in non-healthcare settings – personal protective and environmental measures. Centers for Disease Control. 26(5); 2020 May. ~~ https://wwwnc.cdc.gov/eid/article/26/5/19-0994_article

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26. C MacIntyre, H Seale, et al. A cluster randomized trial of cloth masks compared with medical masks in healthcare workers. BMJ Open. 2015; 5(4) ~~ https://bmjopen.bmj.com/content/5/4/e006577.long

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28. M Klompas, C Morris, et al. Universal masking in hospitals in the Covid-19 era. N Eng J Med. 2020; 382 e63. ~~ https://www.nejm.org/doi/full/10.1056/NEJMp2006372

29. E Person, C Lemercier et al. Effect of a surgical mask on six-minute walking distance. Rev Mal Respir. 2018 Mar; 35(3):264-268. ~~ https://pubmed.ncbi.nlm.nih.gov/29395560/

30. B Chandrasekaran, S Fernandes. Exercise with facemask; are we handling a devil's sword – a physiological hypothesis. Med Hypothese. 2020 Jun 22. 144:110002. x ~~ https://pubmed.ncbi.nlm.nih.gov/32590322/

31. P Shuang Ye Tong, A Sugam Kale, et al. Respiratory consequences of N95-type mask usage in pregnant healthcare workers – A controlled clinical study. Antimicrob Resist Infect Control. 2015 Nov 16; 4:48. ~~ https://pubmed.ncbi.nlm.nih.gov/26579222/

32. T Kao, K Huang, et al. The physiological impact of wearing an N95 mask during hemodialysis as a precaution against SARS in patients with end-stage renal disease. J Formos Med Assoc. 2004 Aug; 103(8):624-628. ~~ https://pubmed.ncbi.nlm.nih.gov/15340662/

33. F Blachere, W Lindsley et al. Assessment of influenza virus exposure and recovery from contaminated surgical masks and N95 respirators. J Viro Methods. 2018 Oct; 260:98-106. ~~ https://pubmed.ncbi.nlm.nih.gov/30029810/

34. A Rule, O Apau, et al. Healthcare personnel exposure in an emergency department during influenza season. PLoS One. 2018 Aug 31; 13(8): e0203223. ~~ https://pubmed.ncbi.nlm.nih.gov/30169507/

35. F Blachere, W Lindsley et al. Assessment of influenza virus exposure and recovery from contaminated surgical masks and N95 respirators. J Viro Methods. 2018 Oct; 260:98-106. ~~ https://pubmed.ncbi.nlm.nih.gov/30029810/

36. A Chughtai, S Stelzer-Braid, et al. Contamination by respiratory viruses on our surface of medical masks used by hospital healthcare workers. BMC Infect Dis. 2019 Jun 3; 19(1): 491. ~~ https://pubmed.ncbi.nlm.nih.gov/31159777/

37. L Zhiqing, C Yongyun, et al. J Orthop Translat. 2018 Jun 27; 14:57-62. ~~ https://pubmed.ncbi.nlm.nih.gov/30035033/

38. C MacIntyre, H Seale, et al. A cluster randomized trial of cloth masks compared with medical masks in healthcare workers. BMJ Open. 2015; 5(4) ~~ https://bmjopen.bmj.com/content/5/4/e006577

39. A Beder, U Buyukkocak, et al. Preliminary report on surgical mask induced deoxygenation during major surgery. Neurocirugia. 2008; 19: 121-126. ~~ http://scielo.isciii.es/pdf/neuro/v19n2/3.pdf

40. D Lukashev, B Klebanov, et al. Cutting edge: Hypoxia-inducible factor 1-alpha and its activation-inducible short isoform negatively regulate functions of CD4+ and CD8+ T lymphocytes. J Immunol. 2006 Oct 15; 177(8) 4962-4965. ~~ https://www.jimmunol.org/content/177/8/4962

41. A Sant, A McMichael. Revealing the role of CD4+ T-cells in viral immunity. J Exper Med. 2012 Jun 30; 209(8):1391-1395

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Review of the Medical Literature

42. Here are key anchor points to the extensive scientific literature that establishes that wearing surgical masks and respirators (e.g., "N95") does not reduce the risk of contracting a verified illness:

43. **Jacobs, J. L. et al. (2009)** "Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: A randomized controlled trial," *American Journal of Infection Control*, Volume 37, Issue 5, 417 – 419. https://www.ncbi.nlm.nih.gov/pubmed/19216002

44. N95-masked health-care workers (HCW) were significantly more likely to experience headaches. Face mask use in HCW was not demonstrated to provide benefit in terms of cold symptoms or getting colds.

45. **Cowling, B. et al. (2010)** "Face masks to prevent transmission of influenza virus: A systematic review," *Epidemiology and Infection*, 138(4), 449-456. https://www.cambridge.org/core/journals/epidemiology-and-infection/article/face-masks-to-prevent-transmission-of-influenza-virus-a-systematic-review/64D368496EBDE0AFCC6639CCC9D8BC05

46. None of the studies reviewed showed a benefit from wearing a mask, in either HCW or community members in households (H). See summary Tables 1 and 2 therein.

47. **bin-Reza et al. (2012)** "The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence," *Influenza and Other Respiratory Viruses* 6(4), 257-267. https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1750-2659.2011.00307.x

48. "There were 17 eligible studies. … **None of the studies established a conclusive relationship between mask/respirator use and protection against influenza infection**."

49. **Smith, J.D. et al. (2016)** "Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis," *CMAJ* Mar 2016 https://www.cmaj.ca/content/188/8/567

50. "We identified six clinical studies … . In the meta-analysis of the clinical studies, we found no significant difference between N95 respirators and surgical masks in associated risk of (a) laboratory-confirmed respiratory infection, (b) influenza-like illness, or (c) reported work-place absenteeism."

51. **Offeddu, V. et al. (2017)** "Effectiveness of Masks and Respirators Against Respiratory Infections in Healthcare Workers: A Systematic Review and Meta-Analysis," *Clinical Infectious Diseases*, Volume 65, Issue 11, 1 December 2017, Pages 1934-1942, https://academic.oup.com/cid/article/65/11/1934/4068747

52. "Self-reported assessment of clinical outcomes was prone to bias. Evidence of a protective effect of masks or respirators against verified respiratory infection (VRI) was not statistically significant"; as per Fig. 2c therein:

53. **Radonovich, L.J. et al. (2019)** "N95 Respirators vs Medical Masks for Preventing Influenza Among Health Care Personnel: A Randomized Clinical Trial," *JAMA*. 2019; 322(9): 824-833. https://jamanetwork.com/journals/jama/fullarticle/2749214

54. "Among 2862 randomized participants, 2371 completed the study and accounted for 5180 HCW-seasons. … Among outpatient health care personnel, N95 respirators vs medical masks as worn by participants in this trial resulted in no significant difference in the incidence of laboratory-confirmed influenza."

55. **Long, Y. et al. (2020)** "Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis," *J Evid Based Med*. 2020; 1-9. https://onlinelibrary.wiley.com/doi/epdf/10.1111/jebm.12381

56. "A total of six RCTs involving 9,171 participants were included. There were no statistically significant differences in preventing laboratory-confirmed influenza, laboratory-confirmed respiratory viral infections, laboratory-confirmed respiratory infection, and influenza-like illness using N95 respirators and surgical masks. Meta-analysis indicated a protective effect of N95 respirators against laboratory-confirmed bacterial colonization (RR = 0.58, 95% CI 0.43-0.78). The use of N95 respirators compared with surgical masks is not associated with a lower risk of laboratory-confirmed influenza."

57. Conclusion Regarding That Masks Do Not Work

58. No RCT study with verified outcome shows a benefit for HCW or community members in households to wearing a mask or respirator. There is no such study. There are no exceptions.

59. Likewise, no study exists that shows a benefit from a broad policy to wear masks in public (more on this below).

60. Furthermore, if there were any benefit to wearing a mask, because of the blocking power against droplets and aerosol particles, then there should be more benefit from wearing a respirator (N95) compared to a surgical mask, yet several large meta-analyses, and all the RCT, prove that there is no such relative benefit.

61. Masks and respirators do not work. https://www.rcreader.com/commentary/masks-dont-work-covid-a-review-of-science-relevant-to-covide-19-social-policy

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New Danish Study - https://www.acpjournals.org/doi/10.7326/M20-6817

62. Stanford Study - The existing scientific evidences challenge the safety and efficacy of wearing facemask as preventive intervention for COVID-19. The data suggest that both medical and non-medical facemasks are ineffective to block human-to-human transmission of viral and infectious disease such SARS-CoV-2 and COVID-19, supporting against the usage of facemasks. https://www.sciencedirect.com/science/article/pii/S0306987720333028#b0280 This link has been redacted https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7680614/

63. SECOND STUDY This Time from CDC WEBSITE Confirms Stanford Study on Face Masks Being Harmful – Cause Serious Side Effects https://www.thegatewaypundit.com/2021/04/stanford-study-noting-ineffectiveness-harm-masks-censored-twitter-now-second-study-published-cdcs-website-confirms-masks-cause-serious-side-effects/?utm_source=Email&utm_medium=the-gateway-pundit&utm_campaign=dailypm&utm_content=daily

64. Predominant Role of Bacterial Pneumonia as a Cause of Death in Pandemic Influenza: Implications for Pandemic Influenza Preparedness https://academic.oup.com/jid/article/198/7/962/2192118

Please advise if DH or EECD could respond please?
Thanks
Shonna

From: ██
Sent: Wednesday, September 15, 2021 8:27 AM
To: Austin, Kris (LEG) <Kris.Austin@gnb.ca>; asdwinfo@nbed.nb.ca; Doucett, Michelle (ASD-W) <Michelle.Doucett@nbed.nb.ca>; Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>; Allen-VanderToorn, Shawna (ASD-W) <shawna.allen@nbed.nb.ca>
Subject: My daughters absence from school

ATTENTION! External email / courriel externe.

Good morning,
My daughter, 21(1)████████, will remain home until the unreasonable mask mandate is lifted.
These masks are being used as a political dogma. My daughter will not be taking part in Dominic Cardy's tyrannical power grab. The education minister should be relived of his duties. He is just barely falling short of inciting violence and is most definitely calling for segregation. That is not the type of human being who should be in charge of making decisions for all of the children in New Brunswick.
I don't know how so many educated people in power can allow this to be happening to the children. Masks lose their effectiveness after approximately 20 minutes due to saturation from the vapours of your breath. They cause more harm than good when not used effectively. Children cannot use masks effectively. They touch them, drop them, some will use the same one repeatedly. Masks collect bacteria and mold which would be more dangerous for our children to breathe in than the Covid virus.
The physical ailments that will arise from constant mask wearing FAR outweigh the very slight sense of security that they may stop a child from spreading Covid. Oxygen levels are decreased when a mask is worn all day. Hypoxia can actually make cellular invasion of Covid more likely! It's like you want our children to get sick. The lowered levels of oxygen in the blood can also increase the risk of blood clot formation, which is very scary as one of the more fatal side effects of the vaccine that Cardy is trying to push on our children is the formation of blood clots. Lack of oxygen to the brain can also cause neurodegenerative disease which we wouldn't know about until years down the road. Do you want to be responsible for a generation of children developing this? They are our future. You are all risking their health and stunting their immune systems by allowing the mask mandate. Children are naturally better at fighting off viruses. I will repeat, it's like you want our children to get sick! This would help sensationalize your press conferences and possibly coerce more people to take your vaccine.
The mental health of these children should be first and foremost in your minds as well. The masks are so psychologically damaging to these kids. The push for segregation of the "unvaxxed" will create even more anxiety, depression and possibly suicide in our youth. In the United States last year there was a 25% increase in emergency room mental health issues for children 5-11. Do you want to be a

part of this statistic? Do you want to sit home at night and wonder if the next adolescent suicide was somehow, even a small part, rested on your shoulders?

I will take a stand for my daughters health and well being. We are saying no to the masks. I am fully prepared to home school my daughter. This is our last resort, as I have always loved for my daughter to go to school. Please stand up for what is right for all of the children. Dominic Cardy must be fired and our children have to be the first priority.

Respectfully,

21(1)

From:	21(1)
To:	Higgs, Premier Blaine (PO/CPM); Cardy, Dominic Hon. (EECD/EDPE); Daley, George (EECD/EDPE); Holland, Mike Hon. (DNRED/MRNDE); Wetmore, Ross (LEG); Wilson, Pamela W. (ASD-E); Prosser, Stephanie (ASD-E); Johnston-Lovely, Tracy (ASD-E); Keith, Abbey (ASD-E); Russell, Dr. Jennifer (DH/MS); Shephard, Dorothy Hon. (DH/MS); Gervais, Nicole (EECD/EDPE); Muecke, Dr. Cristin (DH/MS)
Subject:	Unmask our children
Date:	October 15, 2021 9:10:00 AM
Attachments:	Mask studies.pdf

<mark>**ATTENTION! External email / courriel externe.**</mark>

Government & School Officials:

I'm calling for you again to get rid of masks on our children in schools and daycares. Covid-19 poses ZERO risk on our children. Masks are simply unnecessary and do harm to our children. Masks do not work, even when they are used properly which is NEVER the case. Not even our own chief medical officer can use a mask correctly as can be seen in every press conference she is a part of.

Masks are extremely hot and uncomfortable. Children cannot learn properly if they are not comfortable. Masks make the children feel unsafe and full of fear. The data shows us that children do NOT need to be afraid.

I'm attaching a list of over 47 studies that show masks do not work as well as 32 studies that confirm they have negative health effects. While I don't expect you guys to look at this, but unlike you guys, I have studies that backup my claims.

Sincerely,

21(1)

VARIOUS FACE MASK STUDIES PROVE THEIR INEFFECTIVENESS

1. **Surgical mask / cloth face mask studies**

Community and Close Contact Exposures Associated with COVID-19 Among Symptomatic Adults ≥18 Years in 11 Outpatient Health Care Facilities — United States, July 2020

The US Centre for Disease Control performed a study which showed that 85 percent of those who contracted Covid-19 during July 2020 were mask wearers. Just 3.9 percent of the study participanets never wore a mask.

Original: https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6936a5-H.pdf

Erratum. correction:
https://www.cdc.gov/mmwr/volumes/69/wr/mm6938a7.htm?s_cid=mm6938a7_w
https://www.theblaze.com/op-ed/horowitz-cdc-study-covid-masks

2. **Facial protection for healthcare workers during pandemics: a scoping review**

This study used 5462 peer-reviewed articles and 41 grey literature records.

"Conclusion: The COVID-19 pandemic has led to critical shortages of medical-grade PPE. Alternative forms of facial protection offer inferior protection. More robust evidence is required on different types of medical-grade facial protection. As research on COVID-19 advances, investigators should continue to examine the impact on alternatives of medical-grade facial protection"

So how is your cloth and surgical mask working again if EVEN medical grade alternatives are failing ?

Study Article: https://pubmed.ncbi.nlm.nih.gov/32371574/

3. **Physical interventions to interrupt or reduce the spread of respiratory viruses**

"There is moderate certainty evidence that wearing a mask probably makes little or no difference to the outcome of laboratory-confirmed influenza compared to not wearing a mask"

Study article: https://pubmed.ncbi.nlm.nih.gov/33215698/

4. **Disposable surgical face masks for preventing surgical wound infection in clean surgery**

"We included three trials, involving a total of 2106 participants. There was no statistically significant difference in infection rates between the masked and unmasked group in any of the trials"

Study article: https://pubmed.ncbi.nlm.nih.gov/27115326/

5. **Disposable surgical face masks: a systematic review**

Two randomised controlled trials were included involving a total of 1453 patients. In a small trial there was a trend towards masks being associated with fewer infections, whereas in a large trial there was no difference in infection rates between the masked and unmasked group.

Study article: https://pubmed.ncbi.nlm.nih.gov/16295987/

6. **Evaluating the efficacy of cloth facemasks in reducing particulate matter exposure**

"Our results suggest that cloth masks are only marginally beneficial in protecting individuals from particles<2.5 μm"

Study article: https://pubmed.ncbi.nlm.nih.gov/27531371/

7. **Face seal leakage of half masks and surgical masks**

"The filtration efficiency of the filter materials was good, over 95%, for particles above 5 micron in diameter but great variation existed for smaller particles.

Coronavirus is 0.125 microns. therefore these masks wouldn't protect you from the virus"

Study article: https://pubmed.ncbi.nlm.nih.gov/4014006/

8. **Comparison of the Filter Efficiency of Medical Nonwoven Fabrics against Three Different Microbe Aerosols**

"The filter efficiencies against influenza virus particles were the lowest"

"We conclude that the filter efficiency test using the phi-X174 phage aerosol may overestimate the protective performance of nonwoven fabrics with filter structure compared to that against real pathogens such as the influenza virus"

Study article: https://pubmed.ncbi.nlm.nih.gov/29910210/

9. **Aerosol penetration through surgical masks**

"Although surgical mask media may be adequate to remove bacteria exhaled or expelled by health care workers, they may not be sufficient to remove the submicrometer-size aerosols containing pathogens "

Study article: https://pubmed.ncbi.nlm.nih.gov/1524265/

10. Particle removal from air by face masks made from Sterilization Wraps: Effectiveness and Reusability

"We found that 60 GSM face mask had particle capture efficiency of 94% for total particles greater than 0.3 microns"

How big is the virus again? 0.125 microns.

Study article: https://pubmed.ncbi.nlm.nih.gov/33052962/

11. A New Method for Testing Filtration Efficiency of Mask Materials Under Sneeze-like Pressure

This study states that "alternatives" like silk and gauze etc could possibly be good options in the pandemic. It's done on starch particles. Does not state how big they are either, but they can still get through the material and my research points that starch particles are "big" much bigger than most viruses.

Study article: https://pubmed.ncbi.nlm.nih.gov/32503823/

12. Protecting staff against airborne viral particles: in vivo efficiency of laser masks

"The laser mask provided significantly less protection than the FFP2 respirator (P=0.02), and only marginally more protection than the surgical mask. The continued use of laser masks for respiratory protection is questionable. Taping masks to the face only provided a small improvement in protection"

Study article: https://pubmed.ncbi.nlm.nih.gov/16920222/

13. Quantitative Method for Comparative Assessment of Particle Removal Efficiency of Fabric Masks as Alternatives to Standard Surgical Masks for PPE

"Worn as designed, both commercial surgical masks and cloth masks had widely varying effectiveness (53 – 75 percent and 28 – 91 percent particle removal efficiency, respectively)". Different brand, different results and only when they applied a "nylon layers" did the "efficiency" improve. Synthetic fibres do not breathe, so this will inevitably effect your breathing.

Study article: https://pubmed.ncbi.nlm.nih.gov/32838296/

14. The efficacy of standard surgical face masks: an investigation using "tracer particles"

"Since the microspheres were not identified on the exterior of these face masks, they must have escaped around the mask edges and found their way into the wound" human albumin cells aka aborted fetal tissue, is much larger than the virus and still escaped the mask.

Study article: https://pubmed.ncbi.nlm.nih.gov/7379387/

15. Testing the efficacy of homemade masks: would they protect in an influenza pandemic?

"Our findings suggest that a homemade mask should only be considered as a last resort to prevent droplet transmission from infected individuals" so why have the government suggested you make your own when they are not effective ?

Study article: https://pubmed.ncbi.nlm.nih.gov/24229526/

16. Using half-facepiece respirators for H1N1

"Increasing the filtration level of a particle respirator does not increase the respirator's ability to reduce a user's exposure to contaminants"

https://pubmed.ncbi.nlm.nih.gov/19927872/

17. Why Masks Don't Work Against COVID-19

The site is full of studies proving masks dont work for coronavirus or the flu.

Article:

https://www.citizensforfreespeech.org/why_masks_don_t_work_against_covid_19?fbclid=IwAR0Qviyvt6BObOgaMij03Cj0fgTcm_gm5jhXcMkO8GcH3Kur-bwib0o8rf8

18. Masks Don't Work: A Review of Science Relevant to COVID-19 Social Policy

This is full of studies proving mask protection is negligible for coronavirus, flu etc

Article: https://www.rcreader.com/commentary/masks-dont-work-covid-a-review-of-science-relevant-to-covide-19-social-policy?fbclid=IwAR0Qviyvt6BObOgaMij03Cj0fgTcm_gm5jhXcMkO8GcH3Kur-bwib0o8rf8

19. Face masks to prevent transmission of influenza virus: a systematic review

There is fewer data to support the use of face masks or respirators to prevent becoming infected.

Study article: https://pubmed.ncbi.nlm.nih.gov/20092668/

20. "Exercise with facemask; Are we handling a devil's sword?" – A physiological hypothesis

No evidence to suggest that wearing a mask during exercise offers any benefit from the droplet transfer from the virus.

"Exercising with facemasks may reduce available Oxygen and increase air trapping preventing substantial carbon dioxide exchange. The hypercapnic hypoxia may potentially increase acidic environment, cardiac overload, anaerobic metabolism and renal overload, which may substantially aggravate the underlying pathology of established chronic diseases"
  Study article: https://pubmed.ncbi.nlm.nih.gov/32590322/

21. Use of face masks by non-scrubbed operating room staff: a randomized controlled trial
Surgical site infection rates did not increase when non-scrubbed personnel did not wear face masks. 2010
Study article: https://pubmed.ncbi.nlm.nih.gov/20575920/

22. Surgical face masks in modern operating rooms – a costly and unnecessary ritual?
  When the wearing of face masks by non-scrubbed staff working in an operating room with forced ventilation seems to be unnecessary.
  Study article: https://pubmed.ncbi.nlm.nih.gov/1680906/

23. Masks: a ward investigation and review of the literature
Wearing multi layer operating room masks for every visit had no effect on nose and throat carriage rates.
  Study article: https://pubmed.ncbi.nlm.nih.gov/2873176/

24. Aerosol penetration and leakage characteristics of masks used in the health care industry
  The protection provided by surgical masks may be insufficient in environments containing potentially hazardous submirconometer-sized aerosols.
  "Conclusion: We conclude that the protection provided by surgical masks may be insufficient in environments containing potentially hazardous submicrometer-sized aerosols"
  Study article: https://pubmed.ncbi.nlm.nih.gov/8239046/

25. Masks for prevention of viral respiratory infections among health care workers and the public: PEER umbrella systematic review
  Meta analysis review that says there is limited evidence to suggest that the use of masks may reduce the risk of spreading viral respiratory infections.
  Study article: https://pubmed.ncbi.nlm.nih.gov/32675098/

26. Modeling of the Transmission of Coronaviruses, Measles Virus, Influenza Virus, *Mycobacterium tuberculosis*, and *Legionella pneumophila* in Dental Clinics
  Evidence to suggest that transmission probability is strongly driven by indoor air quality, followed by patient effectiveness and the least by respiratory protection via mask use.
  So this could explain "second waves" and has nothing to do with hand shaking, or not wearing a mask.
  Study article: https://pubmed.ncbi.nlm.nih.gov/32614681/

27. Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings-Personal Protective and Environmental Measures
  The use of face masks, either by infected or non infected peresons, does not have a significant effect on influenza transmission.
  SO MASKS DON'T PROTECT YOU FROM ME, AND VICE VERSA.
  Study article: https://pubmed.ncbi.nlm.nih.gov/32027586/

28. Effectiveness of personal protective measures in reducing pandemic influenza transmission: A systematic review and meta-analysis
  Meta analyses suggest that regular hand hygiene provided a significant protective effect over face masks and their insignificant protection.
  Study article: https://pubmed.ncbi.nlm.nih.gov/28487207/

29. Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis
  Use of n95 respirators compared to surgical masks is not associated with a lower risk of laboratory confirmed influenza.
  Study article: https://pubmed.ncbi.nlm.nih.gov/32167245/

30. Adolescents' face mask usage and contact transmission in novel Coronavirus
  Face masks surfaces can become contamination sources. People are storing them in their pockets, bags, putting them on tables, people are reusing them etc. This is why this study is relevant:

Study article: https://pubmed.ncbi.nlm.nih.gov/32582579/

31. Visualizing the effectiveness of face masks in obstructing respiratory jets
Loosely folded face masks and "bandana style" face coverings provide minimum stopping capability for the smallest aerosolized droplets.

This applies to anyone who folds or shoves a mask into their pockets or bad. It also applies to cloth and homemade cloth masks:
Study article: https://pubmed.ncbi.nlm.nih.gov/32624649/

32. Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: a randomized controlled trial
Face mask use in healthcare workers has not been demonstrated to provide benefit in terms of colds symptoms or getting colds.
Study article: https://pubmed.ncbi.nlm.nih.gov/19216002/

33. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers
Penetration of cloth masks by influenza particles was almost 97 percent and medical masks 44 percent. so cloth masks are essentially useless, and "medical grade" masks don't provide adequate protection.
Study article: https://pubmed.ncbi.nlm.nih.gov/25903751/

34. Simple respiratory protection–evaluation of the filtration performance of cloth masks and common fabric materials against 20-1000 nm size particles
Cloth masks and other fabric materials tested in the study had 40-90 percent instantaneous penetration levels against polydisperse NaCl aerosols.

"Results obtained in the study show that common fabric materials may provide marginal protection against nanoparticles, including those in the size ranges of virus-containing particles in exhaled breath"
Study article: https://pubmed.ncbi.nlm.nih.gov/20584862/

35. Respiratory performance offered by N95 respirators and surgical masks: human subject evaluation with NaCl aerosol representing bacterial and viral particle size range
"The study indicates that N95 filtering facepiece respirators may not achieve the expected protection level against bacteria and viruses"
Study article: https://pubmed.ncbi.nlm.nih.gov/18326870/

36. Do N95 respirators provide 95% protection level against airborne viruses, and how adequate are surgical masks?
The n95 filtering respirators may not provide expected protection level against small virons
Study article: https://pubmed.ncbi.nlm.nih.gov/16490606/

37. Do Surgical Masks Stop the Coronavirus?
Study article: https://slate.com/news-and-politics/2020/01/coronavirus-surgical-masks-china.html

38. Effectiveness of personal protective measures in reducing pandemic influenza transmission: A systematic review and meta-analysis
This study states that an N95, depending on the brand, can range from 0.1-0.3 microns. however, most people cannot buy an N95 with a micron smaller than 0.3 micron because they are expensive and not readily available on the public market.

"N95 respirators made by different companies were found to have different filtration efficiencies for the most penetrating particle size (0.1 to 0.3 micron)"

" Above the most penetrating particle size the filtration efficiency increases with size; it reaches approximately 99.5% or higher at about 0.75 micron"

" Meta-analyses suggest that regular hand hygiene provided a significant protective effect (OR=0.62; 95% CI 0.52-0.73; I2=0%), and facemask use provided a non-significant protective effect (OR=0.53; 95% CI 0.16-1.71; I2=48%) against 2009 pandemic influenza infection"
Study article: https://pubmed.ncbi.nlm.nih.gov/28487207/

39. Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis
"The use of N95 respirators compared with surgical masks is not associated with a lower risk of laboratory-confirmed influenza. It suggests that N95 respirators should not be recommended for the general public, neither non high-risk medical staff who are not in close contact with influenza patients or suspected patients"

N95 masks did show a positive effect for BACTERIA but not viruses.
Study article: https://pubmed.ncbi.nlm.nih.gov/32167245/

40. Adolescents' face mask usage and contact transmission in novel Coronavirus
This study used dye to show if masks were contaminated. "As a result, masks surface become a contamination source. In the contact experiment, ten adults were requested to don and doff a surgical mask while doing a word processing task. The extended contamination areas were recorded and identified by image analysis"
Study article: https://pubmed.ncbi.nlm.nih.gov/32582579/

41. Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: a randomized controlled trial
"Of the 8 symptoms recorded daily, subjects in the mask group were significantly more likely to experience headache during the study period"
"Face mask use in health care workers has not been demonstrated to provide benefit in terms of cold symptoms or getting colds"
Study article: https://pubmed.ncbi.nlm.nih.gov/19216002/

42. Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers : A Randomized Controlled Trial
"The recommendation to wear surgical masks to supplement other public health measures did not reduce the SARS-CoV-2 infection rate among wearers by more than 50 percent in a community with modest infection rates, some degree of social distancing, and uncommon general mask use"
Study article: https://pubmed.ncbi.nlm.nih.gov/33205991/

43. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers
"An analysis by mask use showed ILI (RR=6.64, 95 percent CI 1.45 to 28.65) and laboratory-confirmed virus (RR=1.72, 95 percent CI 1.01 to 2.94) were significantly higher in the cloth masks group compared with the medical masks group. Penetration of cloth masks by particles was almost 97 percent and medical masks 44 percent"
Study article: https://pubmed.ncbi.nlm.nih.gov/25903751/

44. Respiratory performance offered by N95 respirators and surgical masks: human subject evaluation with NaCl aerosol representing bacterial and viral particle size range
"The study indicates that N95 filtering facepiece respirators may not achieve the expected protection level against bacteria and viruses. An exhalation valve on the N95 respirator does not affect the respiratory protection"
Study article: https://pubmed.ncbi.nlm.nih.gov/18326870/

45. Performance of N95 respirators: filtration efficiency for airborne microbial and inert particles
Coronavirus is 0.125 micron, as you can read in this study, it states that most N95 masks can only filter particles as small as 0.75 microns. This is too big to trap this virus. that is a fact.
And even with an efficiency of 95 percent (depending on brand, so filtration may be lower) IF the virus can be trapped… it's still missing 5 percent and maybe more based on an N95 that has 0.1 microns .
Study article: https://pubmed.ncbi.nlm.nih.gov/9487666/
CORONAVIRUSES ARE 0.125 MICRON. SO THE BEST N95 ON THE MARKET WOULD DO NOTHING .

46. A Novel Coronavirus from Patients with Pneumonia in China, 2019
a chinese study that proves that an airborne coronavirus particle (0.125 micron) can pass directly through an n95 mask
Study article: https://pubmed.ncbi.nlm.nih.gov/31978945/

47. Airborne coronavirus particle (<0.125 micron) will pass directly through a N95 face mask.
Study article: https://www.greenmedinfo.com/article/airborne-coronavirus-particle
SIZE OF THE CORONAVIRUS.
Size can vary but all are smaller than 0.3 micron .
"Human coronaviruses measure between 0.1 and 0.2 microns, which is one to two times below the cutoff"
This "cut off" is referring to the size an N95 mask can trap. Most of us, are not using MEDICAL or regular N95s.

FACE MASK SIDE EFFECTS AND HEALTH IMPLICATIONS

1. Preliminary report on surgical mask induced deoxygenation during major surgery

Face mask side effects include lowered oxygen levels

This study proved that surgeons that wore a mask in surgery for an hour + had significant reductions in blood oxygen saturation.

This is relevant because most of us are being made to wear face masks at work for the whole shift, long journeys on public transport, and when we are in a public places doing shopping etc. and this requires a degree of exertion that is not taken into account.

"Considering our findings, pulse rates of the surgeon's increase and SpO2 decrease after the first hour"

Decreasing oxygen and increasing carbon dioxide in the bloodstream stimulates a compensatory response in the respiratory centers of the brain. These changes in blood gases result in increases in both frequency and depth of breaths. This exposes another risk – if your mask traps some virus you are breathing more hence increasing viral load and exposure.

https://www.sciencedirect.com/science/article/abs/pii/S1130147308702355?via%3Dihub

Study article: https://pubmed.ncbi.nlm.nih.gov/18500410/

2. Impact of structural features on dynamic breathing resistance of healthcare face mask

Face mask side effects include impeded breathing.

Ask people if they have issues breathing in these masks. anecdotal or not, as everyone is different.

"The results showed that each evaluation index was significantly different ($P < 0.05$) among different test masks"

Study article: https://pubmed.ncbi.nlm.nih.gov/31280156/

3. Respiratory consequences of N95-type Mask usage in pregnant healthcare workers-a controlled clinical study

The benefits of using N95 mask to prevent serious emerging infectious diseases should be weighed against potential respiratory consequences associated with extended N95 respirator usage.

Study article: https://pubmed.ncbi.nlm.nih.gov/26579222

"It is known that the N95 mask, if worn for hours, can reduce blood oxygenation in as much as 20 percent, which can lead to a loss of consciousness, as happened to the hapless fellow driving around alone in his car wearing an N95 mask, causing him to pass out, crash his car and sustain injuries. I am sure that we have several cases of elderly individuals or any person with poor lung function passing out, hitting their head. This, of course, can lead to death"

"CONCLUSIONS: Breathing through N95 mask materials have been shown to impede gaseous exchange and impose an additional workload on the metabolic system of pregnant healthcare workers, and this needs to be taken into consideration in guidelines for respirator use"

Yet we force pregnant women to use them…? What could this do to the fetus?

4. Headaches and the N95 face-mask amongst healthcare providers

Face mask side effects include headaches.

These headaches can force you to use added or unnecessary medications like painkillers that carry their own side effects. The theory as to why masks can trigger headaches is the RESTRICTION OF OXYGEN.

What are the long-term health effects on Health Care Workers with headaches arising from impeded breathing? Here are several sources and studies that back up this claim:

Study article: https://pubmed.ncbi.nlm.nih.gov/16441251/

Headaches Associated With Personal Protective Equipment – A Cross-Sectional Study Among Frontline Healthcare Workers During COVID-19

Study article: https://pubmed.ncbi.nlm.nih.gov/32232837/

How to Avoid Migraine Triggers While Wearing Your Mask

https://www.withcove.com/learn/migraine-triggers-mask

5. Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: a randomized controlled trial

"Of the 8 symptoms recorded daily, subjects in the mask group were significantly more likely to experience headaches during the study period"

"Face mask use in health care workers has not been demonstrated to provide benefit in terms of cold symptoms or getting colds"

Study article: https://pubmed.ncbi.nlm.nih.gov/19216002/

6. Your Health Your Responsibility
This video shows that even reading a book with a mask on decreases blood oxygen levels to your brain. what implications does this have for developing children forced to wear masks at school etc?
https://youtu.be/ul5E5BUrlI4

7. Physiological impact of the N95 filtering facepiece respirator on healthcare workers
"CONCLUSIONS: In healthy healthcare workers, FFR did not impose any important physiological burden during 1 hour of use, at realistic clinical work rates, but the FFR dead-space carbon dioxide and oxygen levels were significantly above and below, respectively, the ambient workplace standards, and elevated P(CO2) is a possibility"

Remember in "healthy healthcare workers" even their carbon dioxide levels rose. Most of the wider public have at least one health problem. Even healthy people were shown to have elevated CO2 levels above the healthy guidelines.
Study article: https://pubmed.ncbi.nlm.nih.gov/20420727/

8. The adverse skin reactions of health care workers using personal protective equipment for COVID-19
Face mask side effects include adverse skin reactions
The adverse skin reactions of health care workers using personal protective equipment for COVID-19
Study article: https://pubmed.ncbi.nlm.nih.gov/32541493/

9. Your Mask May Be Causing Candida Growth in Your Mouth
Face mask side effects include yeast infections
https://www.everydayhealth.com/coronavirus/your-mask-may-be-causing-candida-growth-in-your-mouth/

10. 'Mask mouth' is a seriously stinky side effect of wearing masks
Face mask side effects include dental issues
"We're seeing inflammation in people's gums that have been healthy forever, and cavities in people who have never had them before," says Dr. Rob Ramondi, a dentist and co-founder of One Manhattan Dental. "About 50 percent of our patients are being impacted by this, [so] we decided to name it 'mask mouth' — after 'meth mouth.' "
"While mask mouth isn't quite as obvious, if left untreated, the results could be equally harmful.
Gum disease — or periodontal disease — will eventually lead to strokes and an increased risk of heart attacks," says Dr. Marc Sclafani, another co-founder of One Manhattan Dental"
https://nypost.com/2020/08/05/mask-mouth-is-a-seriously-stinky-side-effect-of-wearing-masks/

11. All That Mask-Wearing Could Be Giving You (Gasp!) Mouth Fungus—Here's How to Deal
https://www.wellandgood.com/mouth-sores-from-wearing-masks/

12. 'Maskne' Is a Real Thing—Here's How to Stop Face Mask Breakouts
Face mask side effects include acne
https://www.health.com/condition/skin-conditions/maskne-mask-acne-mechanica

13. Improper use of medical masks can cause infections
Face mask side effects include mould and infections
Masks can cause bacterial and fungal infections around the mouth,and in the mouth and lungs EVEN if you wash the cloth mask. Mould colonies were found in masks in as little as one day.
https://www.aa.com.tr/en/health/improper-use-of-medical-masks-can-cause-infections-/1766676

14. Mould Colonization in Your Sinuses Could Be Holding You Back From Making a Full Recovery
Information on mould and how it can affect your health.
https://moldfreeliving.com/2019/01/26/could-mold-colonization-in-your-sinuses/

15. An investigation into the efficiency of disposable face masks
What are the dangers of bacterial and fungal growths on a used and loaded mask?
This study tested all kinds of disposable masks and proved they cause you to breathe back in your own crap.
Study article: https://pubmed.ncbi.nlm.nih.gov/7440756/

16. Can the Elastic of Surgical Face Masks Stimulate Ear Protrusion in Children?
Disfiguration in children. Can masks stimulate ear protrusion in children?
This is due to masks that are too tightly fitted.
Tight masks can also cause tension headaches. Is this healthy for children long term?

Study article: https://pubmed.ncbi.nlm.nih.gov/32556449/

17. When You Wear A Face Mask Every Day, This Is What Happens To Your Lungs
Mask use can trigger allergies due to the mask collecting particles that stay on you for long periods of time.
https://www.thelist.com/214073/when-you-wear-a-face-mask-every-day-this-is-what-happens-to-your-lungs/

18. The physiological impact of wearing an N95 mask during hemodialysis as a precaution against SARS in patients with end-stage renal disease
The physiological impact of wearing an N95 mask during hemodialysis as a precaution against SARS in patients with end-stage renal disease.
And yet, we make sick people wear them. Even people without breathing issues, have lowered oxygen rates.
Study article: https://pubmed.ncbi.nlm.nih.gov/15340662/

19. Other Face Mask Side Effects and Health Implications to Consider
There is a great potential for harm that may arise from public policies forcing mask use on the wider population. The following unanswered questions arise unanswered:
- Can masks shed fibers or micro plastics that we can breathe in?
- Do these masks excrete chemical substances that are harmful when inhaled?
- Can masks excrete chemicals or fumes when heated, either with bodyheat sunlight or other sources of heat?
- Clothing dye can cause reactions, so how do we know that the manufacturing process of these masks do not pose a risk to us? Because, in reality, we do not buy our masks from medical companies or facilities who operate in sterile environments.

20. [Gaps in asepsis due to surgical caps, face masks, external surfaces of infusion bottles and sterile wrappers of disposable articles]
"It is obvious that the surfaces of the boxes of sterile packed disposable instruments and infusion bottles are not sterile. The disposable surgical masks and surgical caps used for sterile clothing are delivered by the producers not sterile, either." AND THIS IS HOSPITAL EQUIPMENT.
Study article: https://pubmed.ncbi.nlm.nih.gov/6099666/

21. Mask Production Video
This is a "factory" that produces alot of masks. Does this look a sterile environment to you? This is what the majority of us are getting when we purchase online or in stores that sell them in bulk. Do you want that on your face? https://youtu.be/8gyO9TSlC0Q

22. Allergies and the Immune System
Can pathogen-laden droplets interact with environmental dust and aerosols captured on the mask? Can this elicit a greater reaction to viruses? For example, if you have a dust allergy your mask is collecting this thus causing inflamation to the wearer and lowering his or her immune system.
"This can cause wheezing, itching, runny nose, watery or itchy eyes, and other symptoms" would that not facilitate spread and infection rate of viruses?
https://www.hopkinsmedicine.org/health/conditions-and-diseases/allergies-and-the-immune-system

23. Virus interactions with bacteria: Partners in the infectious dance
Bacteria and viruses can interact an increase infection suseptability:
https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1008234

24. When viruses and bacteria unite!
https://blogs.scientificamerican.com/lab-rat/when-viruses-and-bacteria-unite/

25. An empirical and theoretical investigation into the psychological effects of wearing a mask
Face mask side effects include altered behaviour
Are there negative social consequences to a masked society? This study implies that, yes, masks do cause people to adopt altered behaviours based on mask use.
https://strathprints.strath.ac.uk/43402/

26. Mask mandates may affect a child's emotional, intellectual development
Face mask side effects stagnate a child's natural intellectual development
It is well known that children find it hard to recognise faces up untill a certain age. Mask use will further interfere with this. Is this healthy for a developing child?

27. Disabled People and Masks Contributing Toward Mental Health Issues
Face mask side effects and mental health

What about disabled people? Deaf /people hard of hearing rely on mouth reading. What are the implications for them? What about people who suffer cognitive and behavioural disorders like autism? This could cause them HUGE distress. Not just from wearing a mask, but seeing others in masks (because let's face it – IT'S NOT NORMAL BEHAVIOUR).

Can masks cause anxiety, or make other mental health disorders worse?

Since masks CAN impede breathing, this can cause fainting and other bodily reaction that would otherwise be avoided if masks were not used. Here is a search engine link to prove that it is very common:

https://duckduckgo.com/?q=mask+anxiety&ia=web

28. Maine study looks into long-term psychological effects of wearing face masks coronavirus, COVID-19 pandemic

This is a study on the psychological effects of masks.

https://www.msn.com/en-us/health/wellness/umaine-study-looks-into-long-term-psychological-effects-of-wearing-face-masks-coronavirus-covid-19-pandemic/ar-BB13EfiU

29. Masks: Have You Been Captured by This Psyop?

Are there negative psychological consequences to wearing a mask, as a fear-based behavioral modification? This can easily trigger fear as a mask is reminding you there's a virus. The use of mask can also cause you to engage in risky behaviours due to a "false sense of security" because you feel protected.

https://kellybroganmd.com/masks-have-you-been-captured-by-this-psyop/

30. Masking the Truth – Face Masks, Empathy and Dis-inhibition

https://podtail.com/fi/podcast/conspiracy-theoryology/masking-the-truth-face-masks-empathy-and-dis-inhib/

31. Covid-19 face masks: A potential source of microplastic fibers in the environment

What are the environmental consequences of mask manufacturing and disposal?

Proof of increased littering due to increased mask use. a quick engine search will tell you, people are dumping them EVERYWHERE – into our rivers, into greenland areas etc. Plastics like nylon leach chemicals are going into our environment.

https://pubmed.ncbi.nlm.nih.gov/32563114/

32. Why Masks Don't Work Against COVID-19

Can used and loaded masks become vectors of enhanced transmission for both the wearer and other people? (The evidence from studies suggest yes). Masks become useless after about 20 minutes due to the moisture in your breath. This moisture can become the droplets that viruses travel on. Can this not facilitate transmission?

Can masks become collectors and retainers of pathogens that otherwise, could be avoided when breathing without a mask? (The evidence suggests yes).

Can large droplets trapped via a mask become atomized or aerosolized into breathable components? Even down to the virion size. (The evidence suggests yes).

https://www.citizensforfreespeech.org/why_masks_don_t_work_against_covid_19

From:	Crain, Krista (DH/MS) on behalf of Shephard, Dorothy Hon. (DH/MS)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Vaccine safety data please send
Date:	December 1, 2021 10:37:53 AM

From: @gmail.com>

Sent: Wednesday, December 1, 2021 8:30 AM

To: Crossman, Gary Hon. (ELG/EGL-RDC/SDR) <Gary.Crossman@gnb.ca>; Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>

Cc: 21(1) @nb.aibn.com>; 21(1) @gmail.com

Subject: Re: Vaccine safety data please send

Good morning Gary,

You replied thank you, Dorothy I am waiting your response as well.

My email was not in regard to supporting or not supporting vaccines it seems you missed the point but thank you for sharing your viewpoint.

My concerns are that this vaccine has no long term or short term testing on children, that was my point how did you miss that?

Please provide me with the data that you have used to come to a conclusion that this is safe and effective ? Did you do your own critical thinking or not?

This is not the same as other vaccines, this has only been approved due to emergency order, how did you miss that point? Only one can wonder how an elected official who gets paid well over $100k lacks such critical thinking. The vaccines that you say you will continue to support are those that have gone through multiple years of testing for long term effects. It takes at least 5-10 years to gain such data.

So again I will ask the question what data are you reading that is peer reviewed that shows that this MRNA is safe, effective and has no long term side effects? Especially in a population that has no evidence since this pandemic has started that the children even need this. Not one child has died from covid and all experts say kids are fine.

Do you ware glasses to see better when you have 20/20 vision? Do you take diabetes medication when your not diabetic? Do you put your arm in a cast when it's not broken?

Have you ever asked yourself these questions and reflect?

You were an educator for 30 years, didn't you teach critical thinking skills in those years?

I Challenge you to ask these questions to your colleagues, open a dialogue this is what a debate is and is what our democracy is founded on. There should be debate on all issues including this one and this debate should and must include all parents.

I must assume that your critical thinking that allowed you to come to such a conclusion is also the same critical thinking that your environment department is continuing to allow the spraying of our land and province. You do recall the DDT crap that went on was also suppose to be safe and effective..... agent orange... ... the list goes on... California has outright banned this crap due to all the cancer it has caused, the law suits they lost and the fines Monsanto had to pay. Go google it it's available on the internet.

What more do you need to stand up against this crap. ?

Stop following and start leading. Leaders look at all angles and discuss all scenarios with possible outcomes in an open form where debate is possible.

Our democracy doesn't seem to be democratic anymore.

It's sad that this is where we are, future generations deserve more.

Thanks
21(1)

Sent from my iPhone

On Nov 30, 2021, at 3:19 PM, Crossman, Gary Hon. (ELG/EGL-RDC/SDR) <Gary.Crossman@gnb.ca> wrote:

> Good afternoon 21(1),
> As your MLA, I respect all constituents views including yours.
> I have watched the attached video and will continue to support vaccines.
> Thank you again for sharing your concerns. It is appreciated.
> Gary
> Get Outlook for iOS
>
> ---
>
> **From:** 21(1) @gmail.com>
> **Sent:** Tuesday, November 30, 2021 8:28:45 AM
> **To:** Crossman, Gary Hon. (ELG/EGL-RDC/SDR) <Gary.Crossman@gnb.ca>; Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>
> **Cc:** 21(1) @nb.aibn.com>; 21(1) @gmail.com 21(1) @gmail.com>
> **Subject:** Re: Vaccine safety data please send
>
> <mark>**ATTENTION! External email / courriel externe.**</mark>
>
> Hi Gary and Dorothy,
> I see neither of you have responded to this email. Why?
> Are you afraid of a conversation?
> Are you being told not to answer emails from concerned parents?
> What is your agenda here ?
> Typical response from elected individuals, seems to be no response at all. Keep restoring trust in our government by not engaging with the voters it really helps improve trust.... unbelievable..
> Please put a stop to this nonsense, stop using our kids here in nb as test subjects.
> Please watch this video from a Dr in PEI. It seems they have put a 6 month stop to using kids as test subjects. Why can't nb?
> It seems more and more apparent that this is not about health, it's all about control.
> Stop this. In the future when others look back at this time, you both should be ashamed and embarrassed that you didn't do your own critical thinking and stand up to protect kids.
> If you don't have a cut on your hand you don't put a band aid on, if your leg isn't broken you don't put a cast on, if you have 20/20 vision you don't wear glasses,
> If kids are at NO RISK you don't give them a vaccine that has not been properly tested for safety and efficacy. It's not rocket science.
> https://www.youtube.com/watch?v=2YvBETwmlW0
> Please watch this video, I am awaiting your response, please do me a favour and

actually respond, don't waste your time giving me a standard response your communication officer has given you.

I'll await your response,

21(1)

Sent from my iPhone

On Nov 23, 2021, at 2:02 PM, 21(1) wrote:

> Hi Gary and Dorothy,
>
> Hope all is well with you both.
>
> As a parent of 3 children all under 12, I am very concerned with how things are unfolding, and how we are where we are. by the way do either of you have any children under 12? I know Gary doesn't, and I am willing to bet that neither do Dorothy.
>
> This is to address our health ministers comments today and Gary you are my mla and you must represent your voters.
>
> Please send me peer reviewed data to support your comments today. I find these comments lack any evidence and frankly are worthless coming from yours or Dr Russell's mouths.
>
> "I can assure parents that this vaccine has been tested thoroughly on children between the ages of five and 11 and has been found to be very safe and effective" Cbc news quoted you today.
>
> Please send me the peer reviewed data that shows this and supports your comments. Love to read it. Better yet you should disclose it when you make blatant comments like this. If that was your thesis statement and you were defending this to gain your masters or PhD, and you don't have any supportive evidence you would not get your masters or PhD. So why are you allowed to make this statement when you are not even impacted by this. Unbelievable, the lack of transparency from your government stinks and is worthy of a Fail grade in my opinion.
>
> There is no evidence in the world that shows children have anything to worry about when it comes to this alleged covid virus. Not 1 child has died from this in Canada. Not 1. Please let that sink in.
>
> How many children have had adverse reactions to this formula from Pfizer. ? Did you research this ? Did you look into this at all ? I hope you do after you read this.

Health minister did you read that they added blood thinner into the vax for kids? Well they did, but that has not been tested on anyone, once they change the ingredients it's an entirely new game.

I applaud you for not making this mandatory and you better not as there is no scientific evidence to warrant it.

Please protect NB's most valuable assets, which is our children.

Get the masks off our children. This is another issue you need to address. There are no reason to mask kids all day long, in fact in other provinces they do not require masks for kids under 10. The mental long term impact this will have on this generation will only come to light in the years to come.

More and more kids are calling the kids helpline, more and more kids are commuting suicide. Kids need to see facial expressions, this is how they learn to pronounce words. This is how they learn body language. This is how they talk to people without talking, facial expression. Lip reading is a very important tool in early education. How do you not see this?

Will you answer this email ? Time will tell but don't think for a minute that I am alone in feeling this way. More and more will start to speak up against your governments control. We are not here to be controlled by ideological mlas that think they know what is best for me or my kids.

Please send me peered reviewed material showing short term and long term affects of this MRNA vaccine on children. Don't know where you will get this as there isn't even long term studies done for the adult version. These were approved under emergency order.
Why haven't you talked publicly about what is involved with good health? Not once during this has any government official talked about eating healthy, not one person. Not one has talked about how to boost your immune system , let alone even saying the words immune system. Not one has spoken of exercises daily... not one. Why?
Why?

We have data that shows how many ppl have fought off covid in Canada why aren't we comparing those profiles to those who didn't have a strong immune system? Why ?

In police work they profile, they figure out what the profile is and target to resolve crimes. Why aren't we profiling those who didn't survive covid vs the ones that fought it off no problem ? Don't you think that would be

good data to talk about?

Unbelievable how poorly our health care system is for chronic health issues. We were at capacity before the pandemic why? The system is failing, it's time to fix it.

There needs to be a change. Stop relying on a pill or a drug or a vaccine for health, rather focus on healthy eating, exercise sleep and laughs. Stop dividing the ppl of nb.

Enough is enough.

Thanks for reading if you actually did.

21(1) ███████████████████████████ .

Sent from my iPhone

From: 21(1)

Sent: Wednesday, December 22, 2021 8:08 PM

To: Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>; Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>; Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>; Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>

Subject: Daycare Restrictions - Please Amend!

ATTENTION! External email / courriel externe.

Dear Premier Higgs, Dr. Russell, Mr. Cardy, and Ms. Shephard,

My name is 21(1) and I am a resident of Moncton, NB. I am writing today to challenge the most recent restrictions put into place regarding childcare facilities. I am currently on maternity leave, but am hoping to return to work next month. I am a mother of two young children (ages 10 months and 3 years), one or both of whom consistently has a runny nose, especially during the winter months. My teething son has a runny nose more often than not, as it is a typical side effect of teething.
Are you aware that the act of the body producing mucus in the nose is to trap bacteria, allergens, dust or other harmful particles that come into the nose? It's one of the body's natural defense systems as the mucus contains antibodies and enzymes, which kill unwanted bacteria and viruses. To exclude a child from attending daycare or school due to having a runny nose is ludicrous and the fallout is tremendous (more on that in a moment).

Both the World Health Organization and the Government of Canada no longer classify a runny nose as a symptom of COVID-19. Why does the Government of New Brunswick still list this as a symptom? Given that it is cold and flu season, my children will be prevented from attending their daycare facility if either has one symptom, including a runny nose. This restriction leaves me with no alternative for childcare as my husband and I have no family or support system in New Brunswick. The daycare facility that we pay for weekly is our only support system to allow us to work and provide for our family. My employer provides me with 3 sick days a year. Under the current restrictions, that will easily be used up within my first week or two back to work. And then what?

I will be required to stay at home to care for my child, paying for a service I am no longer able to use and putting my employment at risk. Do you have a plan in place to support the women of this province that may be required to take an unpaid leave of absence from their jobs to care for their children? Or a plan to support them when they become underemployed or unemployed when their employer is no longer willing to tolerate their absences? I am fortunate that I can work from home in my job. However, working from home with a 10-month-old and/or a 3-year-old is next to impossible and will have detrimental impacts to my overall productivity, job security, future growth and development opportunities with my company and maybe most important of all, my mental health.

The restrictions you are implementing for schools and daycare facilities have a disproportionately negative impact on the women in this province. We are overwhelmingly the ones forced to stay at home when our children are unable to attend daycare or school.

My second issue is with masking young children all day, inside and out, under level 2 and

3. You may not be aware if you don't have young children yourselves, but masks tend to get quite wet quite quickly even when inside, as some children have a tendency to lick their masks. Even without that tendency, it should come as no surprise that masks get damp when worn outside due to moisture from breathing. Add to this, temperatures well below zero on a regular basis in the coming months and you have young kids with frozen masks on their face instead of allowing them to breathe in some fresh air. This rule is bizarre enough and sad enough that many parents, including myself, are (along with the runny nose exclusion) considering quitting their jobs. And it's important to note that this is not a decision I take lightly in any way whatsoever. I provide a substantial portion of our family's income and have upwards of eight years of post-secondary education under my belt, including three professional designations (including a CFP and CPA, CA). My career trajectory has taken enough of a hit due to two maternity leaves and I am looking forward to heading back to work next month… in theory. These new rules have me stressed to the max as I feel in limbo as to how to proceed.

I implore you to revisit the restrictions you are putting in place for childcare, including to remove runny nose from your list of symptoms to screen and to remove the new masking rules under level 2 and 3 for young children. You are directly impacting women's ability to work, provide for their families and ultimately contribute to the economy of this province. We are doing our part by being fully vaccinated and staying home when sick. We need you to do your part by addressing the underlying issues with our healthcare system rather than attempt to circumvent them by adding restrictions to your constituents. Please support the residents of this province by removing these restrictions/rules and create a reasonable plan so that we can move forward and learn how to successfully live with this virus.

Respectfully,
21(1) ████████

Get Outlook for iOS

From: 21(1) ██████████████████████████
Sent: Wednesday, December 29, 2021 2:24:05 PM
To: Blain.Higgs@gnb.ca <Blain.Higgs@gnb.ca>; Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>; Gervais, Nicole (EECD/EDPE) <Nicole.Gervais@gnb.ca>; Scott-Wallace, Tammy Hon. (THC/TCP-WEB/EDF) <Tammy.Scott-Wallace@gnb.ca>; Daley, George (EECD/EDPE) <george.daley@gnb.ca>; Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>; Rob.Moore@parl.gc.ca <Rob.Moore@parl.gc.ca>
Subject: Childcare in New Brunswick

ATTENTION! External email / courriel externe.

December 29 2021

Honourable Premier Higgs
Chancery Place
P. O. Box 6000
Fredericton, NB
E3B 5H1
Mr. Premier:
As the **Owner/Administrator** of a licensed child care program I am ethically bound to do what is best for children's physical, mental and emotional health. As an expert in this sector, I have grave concerns regarding the mandatory nature of restrictions being placed upon toddlers and preschool children in phases two and three of your winter plan.

Our child care program must receive the funding needed to operate in a Covid-19 environment, including the use of small separate groups throughout the day when necessary. I am requesting that restrictions related to continuous masking inside and outside, one symptom exclusions and PCR testing be reviewed, as well.

Specifically, it is required that:

- My organization receives the financial assistance it requires to keep child care groups separate during the day.

- Toddlers and preschool children only wear masks in common areas of their child care program or outside of their group when in phases 2 or 3.

- That children and staff of early learning programs be given priority PCR testing to allow the continued provision of services to families of this province safely and without interruption.

That the "one symptom" rule be implemented with the flexibility of our knowledge of children's typical health status in our care.

A response is required on each of my four points above, please.

Many thanks,

--
21(1)

From: Russell, Dr. Jennifer (DH/MS)
To: DH Correspondence / Correspondance MS (DH/MS)
Subject: Fwd: Winter Plan - Concerns
Date: December 29, 2021 3:34:32 PM

Get Outlook for iOS

From: 21(1) ████████████████████████

Sent: Wednesday, December 29, 2021 3:27:40 PM

To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>

Cc: Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>; Oliver, Bill Hon. (LEG) <Bill.Oliver@gnb.ca>; Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>; Gervais, Nicole (EECD/EDPE) <Nicole.Gervais@gnb.ca>

Subject: Winter Plan - Concerns

ATTENTION! External email / courriel externe.

December 29 2021

Honourable Premier Higgs
Chancery Place
P. O. Box 6000
Fredericton, NB
E3B 5H1

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Many thanks,

21(1)

[Sent from Yahoo Mail for iPhone](#)

From:	
To:	COVID-19 Public Enquiries / Demandes publiques COVID-19 (DH/MS)
Subject:	Re: masking small children
Date:	January 20, 2022 9:39:10 AM

ATTENTION! External email / courriel externe.

Canada is one of the only developed nations left still masking children. It's not just that it's a hassle, there are serious development concerns that psychologists and other mental health professionals have raised but our government doesn't seem to pay any attention to. For example, a 5 year old kid has been wearing a mask for nearly half their life now, they don't see others faces, and their development is taking a hit, the ones in elementary school are not even learning how to read. We have cancelled their sports and taken away their activities and made them isolate. All of this to protect them from a cold that is known not to cause them serious illness (top doctors from McMaster Childrens Hospital and the IWK in NS have publicly urged people to understand that this is not more serious than a cold for children) for which adults around them have been vaccinated. At what point do the harms of all this mandatory protocol start to outweigh the benefits?

In case you haven't noticed, our government in Ottawa is thoroughly sick with corruption.

Get Outlook for iOS

From: COVID-19 Public Enquiries / Demandes publiques COVID-19 (DH/MS) <COVID-19NB@gnb.ca>
Sent: Thursday, January 20, 2022 9:17:42 AM
To: 21(1)
Subject: RE: masking small children

Hello 21(1)

Thank you for your email regarding mask wearing recommendation for children age 5 and under from the World Health Organization (WHO), versus current practices in Early Learning and Childcare (ELC) Facilities.

The World Health Organization is a valid resource for information regarding the pandemic, and this organization provides global information and recommendations. It is worth recognizing that their guidance would need to be appropriate for industrialized nations, as well as third world countries where resources are exceedingly scarce to meet their basic daily needs. In these locations, many citizens struggle to have enough fabric to clothe themselves, or to provide shelter for their family from the elements; and lack the resources to make a multilayer mask.

Canada is a developed nation, with living conditions that exceed those of an underdeveloped country. As such, we take the guidance of the WHO into consideration; however, we would follow the advise provided by the Public Health Agency of Canada. COVID-19 mask use: Advice for community settings - Canada.ca .PHAC advises that children under 2 years of age should not wear a mask, and those age 2-5 years may do so if supervised, able to tolerate; and able to remove if required.

We understand the challenges of mask wearing with a younger child; however with a rapidly spreading Omicron variant, mask wearing remains an important measure in a layered approach to protection, particularly among our smallest citizens who are not yet eligible for vaccination. Other protective layers include vaccination of eligible household members, proof of vaccination in public facilities, hand cleaning, using barriers, ventilation, monitoring symptoms and getting tested when symptomatic. By acclimatizing young children to wearing a mask in a safer space where group membership is constant and limited such as ELC facility, they will have the skills to wear the mask in public situations when the mask may be direly needed.

Sincerely,

Department of Health COVID-19 Public Enquiries Team/ l'Équipe de demandes publiques COVID-19 du Ministère de la Santé

For the most up-to-date information, please visit our dedicated COVID-19 website/Pour obtenir les informations les plus récentes, veuillez visiter notre site Web dédié à la COVID-19:

www.gnb.ca/coronavirus

● Be Informed ● Be Safe ● Be Prepared ● Be Kind ●

● Soyez informé ● Soyez protégé ● Soyez préparé ● Soyez bienveillant ●

Good morning Eddie, I will look into this later this morning.

Lucie Michaud, L. Psych.
(elle, she, her)
Health Consultant / Consultante en santé
Addiction and Mental Health Services / Services de santé mentale et traitement des dépendances
Department of Health / Ministère de la santé

Phone / Téléphone : 506-724-1417
E-mail / Courriel : lucie.michaud@gnb.ca
www.gnb.ca

Improving the lives of New Brunswickers every day. /
Améliorer la vie des Néo-Brunswickois au quotidien.

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Ce message est destiné à la personne désignée dans la présente et il doit demeurer confidentiel. Il ne doit pas être réacheminé sans la permission de l'expéditeur. Si ce message vous a été envoyé par erreur, veuillez aviser l'expéditeur et effacer le message. Effacez ensuite votre réponse. Merci de votre collaboration.

De : COVID-19 Public Enquiries / Demandes publiques COVID-19 (DH/MS) <COVID-19NB@gnb.ca>
Envoyé : Tuesday, January 25, 2022 4:20 PM
À : NBHEOC Mental Health (DH/MS) <NBHEOCMentalHealth@gnb.ca>
Objet : RE: Not Vaccinated

This sounds like this person's mental health challenges are quite a burden at this time and I wonder if there is a remedy that could be suggested or perhaps a contact may be necessary?

Eddie

Department of Health COVID-19 Public Enquiries Team/ l'Équipe de demandes publiques COVID-19 du Ministère de la Santé

For the most up-to-date information, please visit our dedicated COVID-19 website/Pour obtenir les informations les plus récentes, veuillez visiter notre site Web dédié à la COVID-19:
www.gnb.ca/coronavirus

● Be Informed ● Be Safe ● Be Prepared ● Be Kind ●
● Soyez informé ● Soyez protégé ● Soyez préparé ● Soyez bienveillant ●

From: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Sent: January 25, 2022 11:07 AM
To: DH Correspondence / Correspondance MS (DH/MS) <DHMC.CMMS@gnb.ca>
Subject: FW: Not Vaccinated

For Department's response.

Thank you,

Sheri Forsythe
Office of the Premier/Cabinet du premier ministre
P.O Box/C. P. 6000 Fredericton NB E3B 5H1 Canada
Email/Courriel: premier@gnb.ca/premier.ministre@gnb.ca

From: 21(1) ███████████████████████
Sent: Monday, January 24, 2022 12:42 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Not Vaccinated

ATTENTION! External email / courriel externe.

Good day Mr. Higgs,
I'm just emailing to inquire about not being able to get vaccinated compared to choosing to not get vaccinated. I understand that it's still in the talking phases so if you don't have an answer for me right now that's understandable. I would like you to at least keep in mind the ones that just can't get it.

I bring this to your attention because when masks became "mandatory" I was told that medical reasons could have an exemption and that it was up to the business. Which I can understand and respect. However when every store is doing it and in some cases the police are even threatened to be called because I have a medical, I feel that is not acceptable. It creates a feeling of isolation and like it wasn't very clearly stated to the store owners. I saw the "mandatory masks" sign with the government logo on it, and they would never say anything about exemptions. Every store had a "mandatory mask" sign be it government or not and not a single one seemed to be accepting exemptions. Having mental health issues before the pandemic, this has only made them worse in the past 2 years.

And now these past few days I've been reading time and time again, "we have to make the unvaxxed uncomfortable", forcing them to get the vaccination if they want to "enjoy life". I can not get a vaccination. I have a serious mental problem that will send me into an uncontrollable panic. I would highly appreciate it if you could make things a little more clearer when making life changing decisions for people.

I hope you take what I say into consideration for me and others that are struggling like me. I'm glad that you recovered from covid and I hope you and everyone else can stay safe for the duration of the pandemic. Thank you for taking the time to read my email and hopefully responding but at the very least listening to it.

21(1)

From: 21(1) @gmail.com>
Sent: Tuesday, January 25, 2022 1:07 PM
To: Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>
Subject: Concerned parent 21(1)

ATTENTION! External email / courriel externe.

Dear Ms. Shephard,
I am writing to you as a concerned citizen and parent in regards to Mr. Cardy's presser yesterday. I want to say the filtration systems in school's are a good idea. They probably should have been in place before covid. My concern is for the masking and continuing of isolation of children from their peers with "bubbles". None of these measures makes sense. There is no good science to accommodate these measures. Let teacher's and staff mask up if they wish.
It is time to let our children be children again and stop sacrificing for us.
I am attaching an excellent toolkit written by experts on guidance for children in grades K-12. I sincerely hope you will look at this and present it to your scientists in Public Health.
I would also like to know what mental health strategies has been placed in school's to help children suffering because of restrictions on their lives?
Regards,
21(1)

Children, COVID, and the urgency of normal

An advocacy toolkit for parents, students, mentors, teachers, and administrators.

January 24th, 2022

"18 months ago it was irresponsible and wrong to say:

- Covid is similar to the flu

- Many people hospitalized or dying just have positive tests, are not sick from Covid

- It's most important to protect the vulnerable

Omicron is different. Now, that's basically correct.

Covid is adapting to us, we need to adapt."

-Former CDC Director Tom Frieden

January 7, 2022

About the authors

Dr. Scott Balsitis started his career in virology as an Emerging Infectious Diseases Fellow at the CDC studying pandemic preparedness. He earned his PhD in Virology at the University of Wisconsin-Madison and completed a Fellowship at the University of California, Berkeley. He has 22 years of experience in virology research, including on vaccines and therapeutics against HIV, Hepatitis B, RSV, Influenza, COVID-19, and other viruses.

Dr. Lucy McBride is a Harvard- and Johns Hopkins-educated internal medicine physician, mental health advocate, and author of a popular COVID-19 newsletter. She has written and spoken extensively about the inseparability of mental and physical health during the pandemic, has articles featured in *The Washington Post* and *USA Today*, and is a regular contributor to *The Atlantic*.

Dr. Monica Gandhi is an infectious disease physician, a professor of medicine at the University of California, San Francisco, and the director of the U.C.S.F. Center for AIDS Research. Her articles on COVID immunology and COVID policy have been featured in *The New York Times*, *The Wall Street Journal*, *The Washington Post*, *The Atlantic*, *Newsweek*, *Time*, and numerous other publications.

Dr. Tracy Beth Hoeg is a PM&R physician affiliated with the University of California-Davis, and an epidemiologist studying COVID transmission in schools. She was senior author on one of the earliest studies on COVID in schools, recently testified before Congress on the impacts of COVID and COVID policies on children, and is currently leading a study on the effectiveness of school COVID mitigation policies.

Dr. Jeanne Noble is Associate Professor of Emergency Medicine at the University of California, San Franisco, and Director of COVID Response for the UCSF Parnassus Emergency Department. She has written about COVID policy and the impacts on children for *The Washington Post*, *The Wall Street Journal*, *Time*, *The Los Angeles Times*, and *The San Francisco Chronicle*.

Dr. Kwadwo Kyeremanteng is the department head of critical care at The Ottawa Hospital. He dedicates his time to care for the sickest of the sick patients in the intensive care unit (ICU). During the COVID-19 pandemic Dr. Kyeremanteng created 'Solving Wellness,' a virtual health & wellness platform for health care professionals. 'Solving Wellness' has been helping address health care burnout and providing health, fitness and self care for its members.

About the authors: Pediatrics

Dr. Jeff Vergales is a pediatrician and pediatric cardiologist at the University of Virginia. His national background in risk management in children placed him at the forefront of developing policy and leading multiple national and state initiatives in management of summer camps, schools and other child congregate care settings during the COVID-19 pandemic.

Dr. Kory Stotesbery is a pediatric psychiatrist at Thomas Jefferson University, Children's National Medical Center, and the Washington Baltimore Center for Psychoanalysis with experience in inpatient, outpatient, residential, and emergency care, with a particular interest in eating disorders.
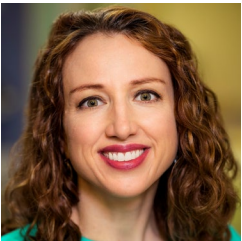
Dr. Kristen Walsh is a Harvard University and University of Missouri-educated clinical academic pediatrician who has been the Early Childhood Champion for the state of NJ for the American Academy of Pediatrics since 2012.

Dr. Amy Beck is an Associate Professor of Pediatrics at the University of California, San Francisco School of Medicine, where she studies the impact of childhood obesity.

Dr. Nicole Johnson is an Assistant Professor of Pediatrics at Case Western Reserve University School of Medicine. She is trained in pediatric critical care and specializes in pediatric procedural sedation. She is passionate about restoring the patient-physician relationship, and the equitable delivery of safe, quality, low-cost medical care.

Dr. Tara Henderson is a pediatric oncology physician, a Professor of Pediatrics and Chief, Section of Pediatric Hematology, Oncology and Stem Cell Transplantation at the University of Chicago. She is health outcomes researcher and specializes in the diagnosis and medical treatment of patients and survivors of pediatric, adolescent and young adult cancers.

Dr. Eliza Holland is a pediatric hospitalist at the University of Virginia Children's Hospital. She has been supporting COVID response to enable in-person activities for students at summer camps in North Carolina and schools in Virginia.

Dr. Aparna Bole is an Associate Professor of Pediatrics at Case Western Reserve University. She is a general pediatrician whose interests include community health, environmental justice, and health equity.

About this toolkit

This toolkit is intended to help everyone who needs to make evidence-based decisions for pre-K and K-12 schools and extracurricular activities. It summarizes the most important data regarding COVID and children of all ages so you can be empowered.

It is intended for parents, students, mentors, teachers, administrators, and everyone invested in taking the best possible care of our children. Please share and discuss within your communities, and use it to help inform and focus discussions with your school.

The discussion is particularly focused toward highly vaccinated communities, because that is where schools are being most impacted by COVID policy changes right now. We highly encourage vaccination.

We urge everyone to have discussions with openness and mutual respect. The job of being a teacher, school administrator, parent, or student has been exceptionally difficult these last two years. Understand that if you're frayed, so is the person you're talking to. Compassion and accurate information will move us forward.

As scientists and physicians, our role is to **inform** you with accurate data, give it **context** you can understand, and provide **guidance** about confusing issues. Impacts from COVID and mental health vary among different communities, schools, families, and individual children. We humbly acknowledge this, and provide these data to support every community in making their **own decisions**.

Children, COVID, and schools

COVID poses very little threat of serious disease for students in highly vaccinated communities.

- COVID is a flu-like risk for unvaccinated children. Extraordinary measures in schools are not justified.

- Vaccinated children have almost no risk of severe disease. Omicron does not change this.

- Teachers remain well protected by vaccination, with boosters important in older age groups.

Protecting the mental, social, and emotional health of students is paramount.

- Children are experiencing unprecedented levels of anxiety, depression, and other mental health impacts.

- Child deaths from suicide vastly outnumber deaths from COVID and are increasing.

Focused protection strategies can protect the vulnerable without harming students' overall wellbeing.

Preserving in-person learning and de-escalating fear are the best responses to Omicron.

- Maintaining in-person learning is critical for protecting our students.

- Escalating COVID rules are harmful. Normalize the daily school experience as much as possible.

To protect our children, an urgent return to fully normal schooling is needed.

COVID is a flu-like risk to unvaccinated children

CDC data show that annual pediatric mortality from COVID is similar to that of the flu in unvaccinated children[1,2]

- Summary of CDC data on 0-17 year olds:

Long COVID is not a major risk to children

- Studies consistently find that post-infection symptoms are similar in children who had COVID and children who had other, non-COVID infections.[3]

US annual pediatric mortality
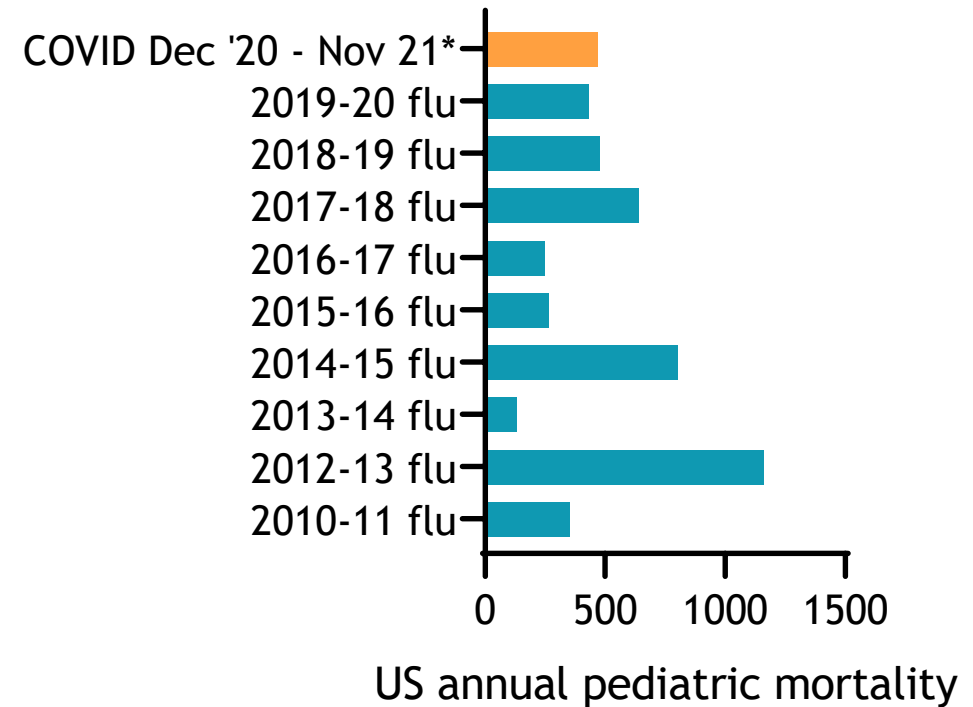
*Dec 2020- Nov 21 was the worst 12 months for pediatric COVID deaths in the United States.

[1]https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm
[2]https://www.cdc.gov/flu/about/burden
[3]https://doi.org/10.1016/j.jinf.2021.11.011

COVID risk to vaccinated healthy children is extremely low

With severe disease risk from COVID already very low for healthy children, vaccines drive the risk to nearly zero.[4]

- Data from the Delta surge shows risk by age and vaccination status.

- Chart shows data from 930,000 total cases, including 411,000 cases in children.

- In vaccinated children, there were zero deaths and almost no hospitalizations.

Covid hospital admission rates in England[5]
Totals between Sept. 6 and Oct. 3, 2021

■ Fully vaccinated ■ Not fully vaccinated

99.1

80 new hospital admissions per 100,000 people

60

49

40

Flu-like risk level in unvaccinated children

20

Vaccinated children

3.9

<18   18-29   30-39   40-49   50-59   60-69   70-79   80+

Age group

46

Vaccines remain highly effective against severe disease with Omicron

With Omicron, vaccines have lost most of their effectiveness against mild disease. Expect many cases. **Efficacy vs. severe disease remains high, and Omicron is less pathogenic.**[6] Cases will be overwhelmingly mild.

The UK reported data by age and vaccination status in December, during massive Omicron spread:[7]
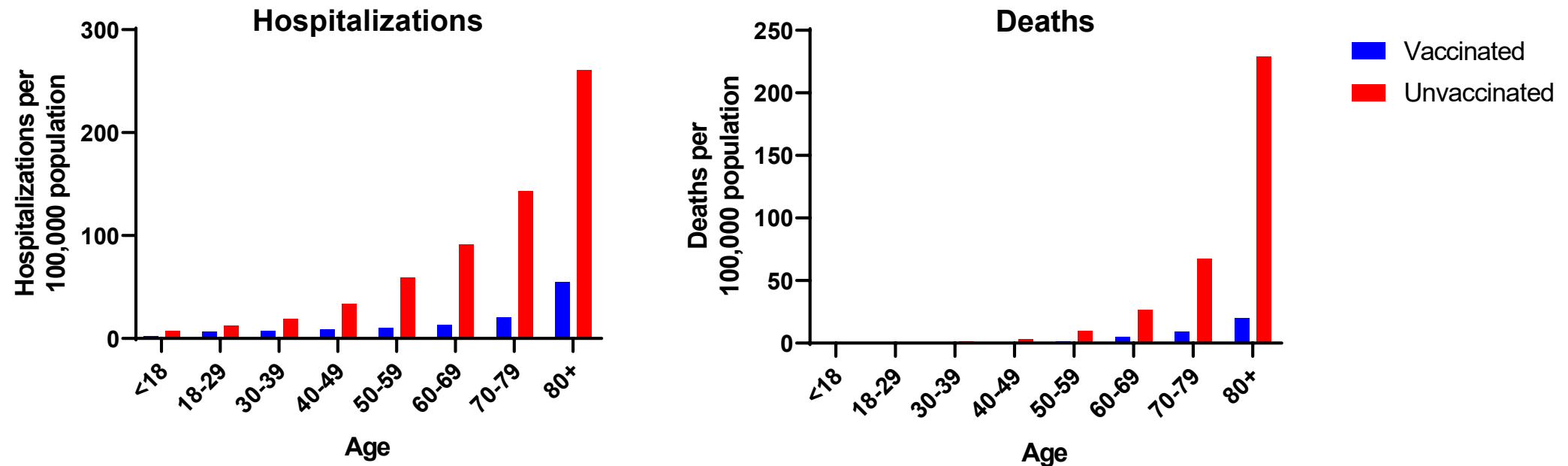
In vaccinated people under age 60, Omicron deaths are extremely rare or absent.
Note that no UK children are boosted. The protection shown here is achieved with two doses.

[6]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1044481/Technical-Briefing-31-Dec-2021-Omicron_severity_update.pdf
[7]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1045329/Vaccine_surveillance_report_week_1_2022.pdf

Teachers, staff, and family members are well-protected by vaccination, with a booster dose important for older age groups

In the previous slide, we see some risk remaining in older age groups, where there is a substantial decline in 2-dose vaccine efficacy against severe Omicron.

In adults over age 65, a booster dose restores protection against hospitalization to pre-Omicron levels (90%).[8,9]

The enhanced protection appears durable, remaining at 90% for at least 10 weeks, the longest monitoring to date.[8]

The UK has decided not to recommend additional boosters. Three doses does the job.

Vaccine effectiveness against hospitalization in people over age 65

% Vaccine efficacy vs Number vaccine doses

[8]https://www.gov.uk/government/news/boosters-continue-to-provide-high-levels-of-protection-against-severe-disease-from-omicron-in-older-adults
[9]https://www.cdc.gov/mmwr/volumes/71/wr/pdfs/mm7104e3-H.pdf
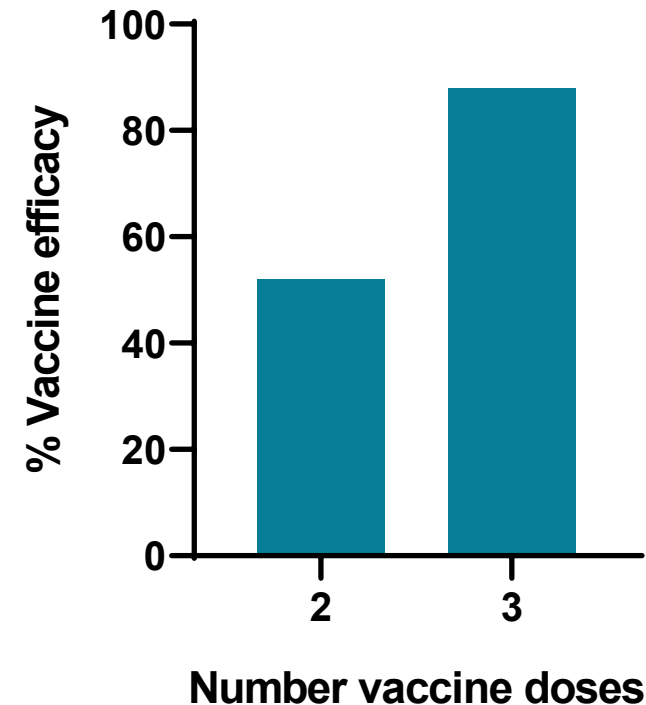
Protecting the mental, social, and emotional health of students should be our top priority

Indicators of student mental health distress are at all-time highs. Policies to improve and protect student mental health are urgently needed.

- Depressive and anxiety symptoms **doubled** during the pandemic.[10]

- **25%** of youth are experiencing depressive symptoms and **20%** of youth are experiencing anxiety symptoms.[10]

- A study of eating disorder hospitalizations found a **120% increase**.[11]

- There were approximately **2400** child suicides in the US in 2020. Children were the only age group to show an increase in suicides from 2019-2020.[12]

- In early 2021, emergency department visits for suspected suicide attempts in the US increased **51%** in adolescent girls.[13]

[10]https://www.hhs.gov/sites/default/files/surgeon-general-youth-mental-health-advisory.pdf
[11]https://publications.aap.org/pediatrics/article/148/4/e2021052201/179731/Medical-Admissions-Among-Adolescents-With-Eating
[12]https://www.cdc.gov/nchs/data/vsrr/VSRR016.pdf
[13]https://www.cdc.gov/mmwr/volumes/70/wr/mm7024e1.htm
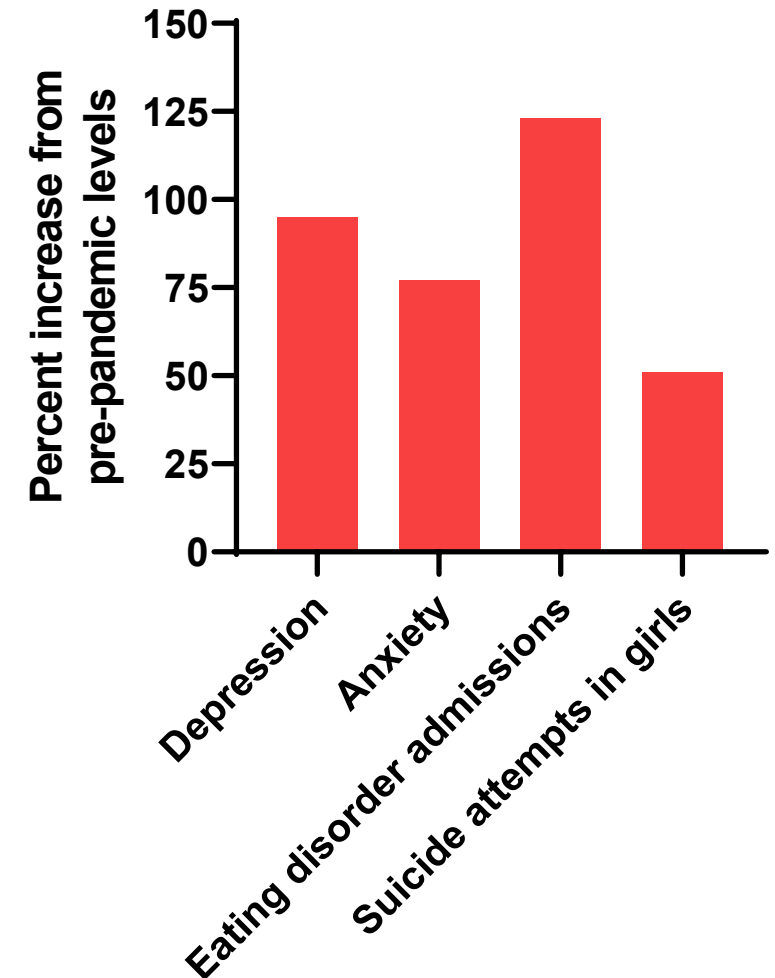
School closures are harmful

"The toll of school closures and social isolation on children's mental health cannot be overstated and will require both immediate- and long-term investigation and action to fully assess and address the impact."[14]

-Editorial from *Journal of the American Medical Association Pediatrics,* January 18, 2022

School closures were associated with:

- Negative mental health impacts for **both parents and students**[15]

- Considerable impacts across emotional, behavioural and restlessness/inattention problems[16]

- Marked rises in screen-time and social media use and reductions in physical activity[16]

- Increased obesity[17]

- Learning loss[18]

Most students are falling behind, but students of color are faring worse.

Amount students learned in the 2019–20 school year, % of historical scores[1]

● Schools with >50% students of color   All schools average   ● Schools with >50% white students

Reading K–5 average	77	90
Math K–5 average	59	69
Math K	80	84
Math 1	66	75
Math 2	64	76
Math 3	54	66
Math 4	50	62
Math 5	37	53

0 — 100
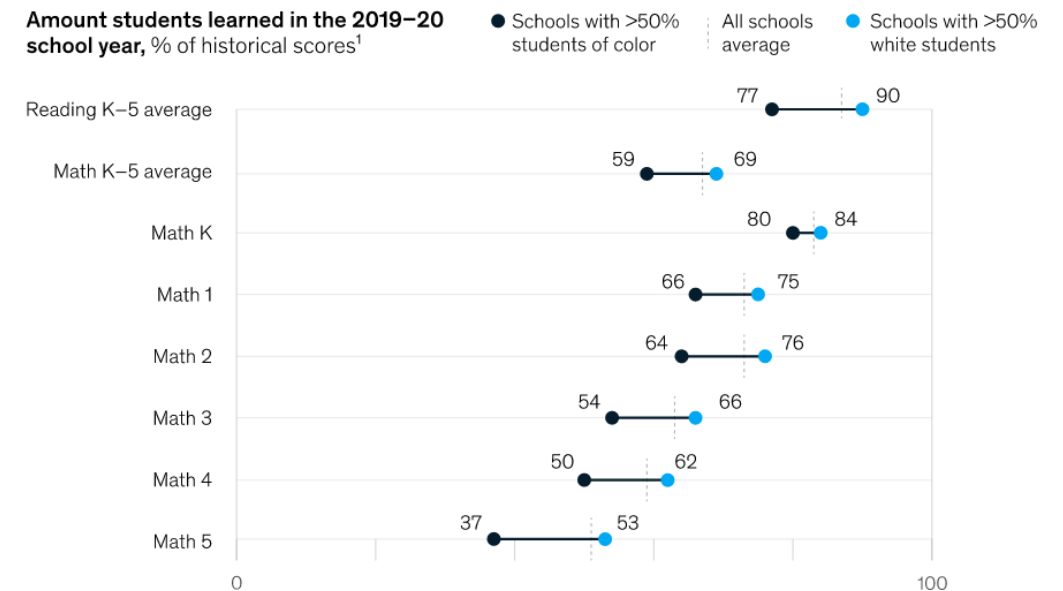
[1]Percent of an "average" year of learning gained by students in 2019–20 school year, where 100% is equivalent to historical matched scores over previous 3 years.
Source: Curriculum Associates

[14]https://jamanetwork.com/journals/jamapediatrics/fullarticle/2788076
[15]https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7011a1-H.pdf
[16]https://jamanetwork.com/journals/jamapediatrics/fullarticle/2788069
[17]https://www.cdc.gov/mmwr/volumes/70/wr/mm7037a3.htm
[18]https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-learning-loss-disparities-grow-and-students-need-help

Focused protection for the vulnerable

The vulnerable must not be forgotten. Even with vaccines available, some people will remain at risk of severe disease from COVID infections.

"Focused protection" methods protect the vulnerable without widespread disruption to society or harms to healthy children.

If you think you are at elevated risk, discuss with your doctor. It is common for members of the general public to incorrectly estimate their personal risk. If you are in a very high-risk category:

1. Get fully vaccinated and boosted. Boosters greatly reduce the risk for the most vulnerable.[19]

2. During periods of high transmission, limit your exposure by quarantining and avoiding indoor public spaces.

3. Use **well-fitted** N95 respirators. A properly-fitted N95 is highly effective at protecting the wearer, and does not rely on the behavior of others around you for protection.[20] **High-quality one-way masking is more effective at protecting the vulnerable than universal use of low-quality masks.**

4. Test right away if you develop respiratory symptoms, and seek early treatment if positive. Multiple effective treatments for all COVID variants now exist, and early treatment is highly effective at preventing severe outcomes of COVID-19.

Focused protection works. It's how we have managed other respiratory viruses for high-risk individuals for our entire lives.

[19]https://www.gov.uk/government/news/boosters-continue-to-provide-high-levels-of-protection-against-severe-disease-from-omicron-in-older-adults
[20]https://www.cdc.gov/niosh/docs/2010-133/pdfs/2010-133.pdf

Recommendations

Maintain in-person learning regardless of case counts. Students' overall health is best supported by keeping daycares, pre-schools, and schools open.

De-escalate fear around getting COVID.

- Talk openly with children and parents about how well the vaccines work and how safe we are.

- For healthy children, COVID is a flu-like risk if unvaccinated and almost no danger if vaccinated.

- Encourage children, parents, and staff to see mild COVID infections as inevitable and not alarming.

- Encourage a booster dose for parents, caregivers and school employees, especially if older or in higher-risk groups.

Apply focused protection measures to protect community members who remain at high risk.

Change the focus to supporting students' mental, emotional, and social health.

- Avoid escalating mask rules or other COVID policies. More restrictive policies increase fear & falsely convey that schools are unsafe. This increases harm to student mental health, which can have major detrimental effects.

- Do not treat vaccinated and unvaccinated children differently. Children are not a danger.

- Encourage extracurricular activities and social events without fear.

- Restore fully normal life and school for all children at the first opportunity.

Health is about more than the mere absence of COVID-19

It is time to appropriately balance risks to children's health

- Disruptions to normal living can never be harm-free

- Coronavirus is here to stay

- We cannot eliminate risk, but we *can* reduce it to levels we've always known how to live with

Reclaiming normal life for our kids is the best way to support and protect them

We Learned Our Lesson Last Year:
Do Not Close Schools

Dec. 20, 2021

By Joseph G. Allen

Dr. Allen is an associate professor and director of the Healthy Buildings program at Harvard T.H. Chan School of Public Health. He is also the chair of the Lancet Covid-19 Commission Task Force on Safe Work, Safe School and Safe Travel.

We encourage you to read this article in the New York Times.[21] Dr. Allen's recommendations overlap completely with our own, and with those of many other infectious disease and public health experts.

"The risk of severe outcomes to kids from coronavirus infection is low, and the risks to kids from being out of school are high."

"We should make masking in schools voluntary rather than mandatory. Masking was a necessary inconvenience early on and in short stints was fine. But to think that two years of masking has no impact on socialization, learning and anxiety is shortsighted. Kids are resilient but not endlessly resilient."

"Schools should never close."

[21]https://www.nytimes.com/2021/12/20/opinion/omicron-schools-do-not-close.html

Appendix: data on student masking

Student masking is the most visible and controversial part of ongoing school COVID mitigations. The most important thing to remember is that the risk of severe disease from COVID-19 for healthy children has always been low, and in vaccinated children COVID is much less dangerous than the flu.

Well-controlled real-world studies have not demonstrated any clear benefit of masking students.

To be informative, studies on school mask usage should evaluate **effectiveness in real-world use**, and **must include a well-matched unmasked control group**.

Several studies meeting this criteria are available, and the results are consistent.

Mask Use and Ventilation Improvements to Reduce COVID-19 Incidence in Elementary Schools — Georgia, November 16–December 11, 2020

Jenna Gettings, DVM[1,2,3]; Michaila Czarnik, MPH[1,4]; Elana Morris, MPH[1]; Elizabeth Haller, MEd[1]; Angela M. Thompson-Paul, PhD[1]; Catherine Rasberry, PhD[1]; Tatiana M. Lanzieri, MD[1]; Jennifer Smith-Grant, MSPH[1]; Tiffany Michelle Aholou, PhD[1]; Ebony Thomas, MPH[2]; Cherie Drenzek, DVM[2]; Duncan MacKellar, DrPH[1]

This CDC study found a 21% lower COVID incidence in schools that required mask use among students, but couldn't be sure the benefit was real. (In scientific terms, "not statistically significant.")[22]

UK Health Security Agency

Department for Education

Evidence Summary

Coronavirus (COVID-19) and the use of face coverings in education settings

January 2022

This evaluation by the United Kingdom's Health Security Agency and Department for Education found an 11% reduction in student COVID cases with mask usage, but also couldn't be sure the benefit was real. (Not statistically significant.)[23]

[22]https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7021e1-H.pdf
[23]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1044767/Evidence_summary_-_face_coverings.pdf

Academic studies confirm the results of government studies on school mask efficacy.

COVID-19 Mitigation Practices and COVID-19 Rates in Schools: Report on Data from Florida, New York and Massachusetts

Emily Oster, Rebecca Jack, Clare Halloran, John Schoof, Diana McLeod

"We do not find any correlations with mask mandates."[24]

Reported COVID-19 Incidence in Wisconsin High School Athletes in Fall 2020 🔓

Phillip Sasser, MD, MS; Timothy McGuine, PhD, LAT; Kristin Haraldsdottir, PhD; Kevin Biese, MA, LAT; Leslie Goodavish, PA; Bethany Stevens; Andrew M. Watson, MD, MS. ✉

J Athl Train (2021)

"There were no significant associations between COVID-19 incidence and face mask use."[25]

Age-dependency of the Propagation Rate of Coronavirus Disease 2019 Inside School Bubble Groups in Catalonia, Spain

Sergio Alonso, PhD,* Enric Alvarez-Lacalle, PhD,* Martí Català, MSc,*† Daniel López, PhD,* Iolanda Jordan, MD, PhD,‡§¶ Juan José García-García, MD, PhD,§¶ Antoni Soriano-Arandes, MD, PhD,** Uxue Lazcano, MSc,†† Pilar Sallés, MSc,‡‡ Marta Masats, MSc,‡‡ Julià Urrutia, MSc,‡‡ Anna Gatell, MD,§§ Ramon Capdevila, MD,¶¶ Pere Soler-Palacin, MD, PhD,** Quique Bassat, MD, PhD,¶‖‖***††† and Clara Prats, PhD*†

In-school COVID transmission was the same in 4-5 year olds where masking was not used and in 6-7 year olds where masking was required.[26]

[24]https://www.medrxiv.org/content/10.1101/2021.05.19.21257467v1.full
[25]https://meridian.allenpress.com/jat/article/doi/10.4085/1062-6050-0185.21/466422/Reported-COVID-19-Incidence-in-Wisconsin-High
[26]https://journals.lww.com/pidj/Fulltext/2021/11000/Age_dependency_of_the_Propagation_Rate_of.2.aspx

Many studies on school masking don't have appropriate controls.

These and other commonly cited studies don't have appropriate control groups and can't tell us anything about whether student masking is effective.

Prevalence and risk factors for in-school transmission of SARS-CoV-2 in Massachusetts K-12 public schools, 2020-2021

Sandra B. Nelson, Caitlin M. Dugdale, Alyssa Bilinski, Duru Cosar, Nira R. Pollock, Andrea Ciaranello

doi: https://doi.org/10.1101/2021.09.22.21263900

"All reported classroom exposures were masked, so these results do not directly inform the impact of masking within classrooms."[27]

Association Between K–12 School Mask Policies and School-Associated COVID-19 Outbreaks — Maricopa and Pima Counties, Arizona, July–August 2021

Megan Jehn, PhD[1,*]; J. Mac McCullough, PhD[2,*]; Ariella P. Dale, PhD[3,4]; Matthew Gue[1]; Brian Eller[5]; Theresa Cullen, MD[5]; Sarah E. Scott, MD[4]

This study used a control group, but did not control for vaccination rates and had additional serious flaws.[28] *The Atlantic* published a thorough critique with the conclusion "You can't learn anything about the effects of school mask mandates from this study."[29]

Pediatric COVID-19 Cases in Counties With and Without School Mask Requirements — United States, July 1–September 4, 2021

Samantha E. Budzyn, MPH[1,2]; Mark J. Panaggio, PhD[3]; Sharyn E. Parks, PhD[1]; Marc Papazian[4]; Jake Magid, MEng[4]; Lisa C. Barrios, DrPH[1]

In this study, the masked and unmasked schools were not compared for vaccination rates, and vaccination rates tend to be much higher in counties with mask requirements.[30] The authors state that regarding masks, "causation cannot be inferred."[31]

[27]https://www.medrxiv.org/content/10.1101/2021.09.22.21263900v1
[28]https://www.cdc.gov/mmwr/volumes/70/wr/mm7039e1.htm
[29]https://www.theatlantic.com/science/archive/2021/12/mask-guidelines-cdc-walensky/621035/
[30]https://www.sfgate.com/california-politics/article/California-mask-mandate-omicron-16701224.php
[31]https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7039e3-H.pdf

Focused protection should be applied to vulnerable children too

A very small sub-set of children have medical conditions that affect their immune systems such that they are ineligible for vaccination or are unlikely to respond to vaccination.

These children and their family members should follow the guidance of their medical team to reduce risk and may need to continue masking with a **high-quality, carefully fitted respirators** to protect against COVID and other respiratory viruses.

Proper respirator fit is crucial to maximizing protection, and can be done effectively for those in need of targeted protection. In contrast, untrained respirator use commonly results in poor fit and ineffective filtration.[32]

Focused protection for these children can offer better protection than universal child masking, which has little to no efficacy in well-controlled real-world studies.

No study has shown benefit from universal use of respirators in children, and the potential for harm is large**.**

[32]https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0245688

School masking summary

Student masking has no scientifically established benefit in real-world use.

- When an intervention's real-world benefits are too small to measure, we should feel comfortable ending its use.

- Potential harms from long-term masking are poorly understood, and reports on mask removal have noted social and emotional benefits for students.[33]

Moving to mask-optional policies - and increasing school-based support and interventions for children - will be crucial for student mental health.

- The need for normalcy at school is urgent, but preparing for change may take time in many places. We recommend ending mandatory masking no later than Feb 15th.

- This will allow schools to communicate and prepare, for anxieties to fall as the Omicron peak subsides, and for additional families to get their children fully vaccinated if they so choose. Anyone who wants or needs to continue using a mask is free to do so.

[33]https://www.wbur.org/news/2021/11/12/hopkinton-high-school-mask-free-trial-policy

All analyses and recommendations presented here represent the author's combined perspective, and do not represent the view of any of our employers or institutions.

You can download a copy of the toolkit here:

From:	van der Pluijm, Nina (DH/MS)
To:	Donovan, Wendy (FTB/FCT); Elliott, Jennifer (DH/MS); Leger, Dr. Yves (DH/MS); Salmon, Dr. Andrew (DH/MS); Chalifoux, Mathieu (DH/MS); LeBlanc, Shannon (DH/MS)
Cc:	Higdon, Penny (DH/MS); Walker, Douglas (DH/MS); LeBlanc, Janelle (DH/MS)
Subject:	FW: Johns Hopkins Lockdown Study
Date:	February 4, 2022 8:03:20 AM
Attachments:	a-literature-review-and-meta-analysis-of-the-effects-of-lockdowns-on-covid-19-mortality.pdf

Hi all, FYI only.

Interesting info re: lock-down effectiveness. The conclusion begins on page 40 and starts with: (thanks Doug for sharing)

Conclusions

Overall, our meta-analysis fails to confirm that lockdowns have had a large, significant effect on mortality rates. Studies examining the relationship between lockdown strictness (based on the OxCGRT stringency index) find that the average lockdown in Europe and the United States only reduced COVID-19 mortality by 0.2% compared to a COVID-19 policy based solely on recommendations. Shelter-in-place orders (SIPOs) were also ineffective. They only reduced COVID-19 mortality by 2.9%.

Studies looking at specific NPIs (lockdown vs. no lockdown, facemasks, closing non-essential businesses, border closures, school closures, and limiting gatherings) also find no broad-based evidence of noticeable effects on COVID-19 mortality. However, closing non-essential businesses seems to have had some effect (reducing COVID-19 mortality by 10.6%), which is likely to be related to the closure of bars. Also, masks may reduce COVID-19 mortality, but there is only one study that examines universal mask mandates. The effect of border closures, school closures and limiting gatherings on COVID-19 mortality yields precision-weighted estimates of -0.1%, -4.4%, and 1.6%, respectively. Lockdowns (compared to no lockdowns) also do not reduce COVID-19 mortality.

Nina van der Pluijm

January – March 2022- HEOC Case & Contact Management Cell- Lead Alternate

Janvier - mars 2022- COUMS Cellule de gestion des cas et des contacts- Responsable alterne

Director/ Directrice

Well-being, Legislation & Standards/ Bien-être, législation & normes

Public Health New Brunswick/ Santé publique Nouveau-Brunswick

Department of Health/ Ministère de la Santé

From: Walker, Douglas (DH/MS) <Douglas.Walker@gnb.ca>
Sent: Thursday, February 3, 2022 2:41 PM
To: Higdon, Penny (DH/MS) <penny.higdon@gnb.ca>; van der Pluijm, Nina (DH/MS) <nina.vanderpluijm@gnb.ca>
Subject: FW: Johns Hopkins Lockdown Study

FYI

Studies in Applied Economics

A LITERATURE REVIEW AND META-ANALYSIS OF THE EFFECTS OF LOCKDOWNS ON COVID-19 MORTALITY

Jonas Herby, Lars Jonung, and Steve H. Hanke

Johns Hopkins Institute for Applied Economics,
Global Health, and the Study of Business Enterprise

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A Literature Review and Meta-Analysis of the
Effects of Lockdowns on COVID-19 Mortality

By Jonas Herby, Lars Jonung, and Steve H. Hanke

About the Series

The *Studies in Applied Economics* series is under the general direction of Prof. Steve H. Hanke, Founder and Co-Director of The Johns Hopkins Institute for Applied Economics, Global Health, and the Study of Business Enterprise (hanke@jhu.edu). The views expressed in each working paper are those of the authors and not necessarily those of the institutions that the authors are affiliated with.

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1

Abstract

This systematic review and meta-analysis are designed to determine whether there is empirical evidence to support the belief that "lockdowns" reduce COVID-19 mortality. Lockdowns are defined as the imposition of at least one compulsory, non-pharmaceutical intervention (NPI). NPIs are any government mandate that directly restrict peoples' possibilities, such as policies that limit internal movement, close schools and businesses, and ban international travel. This study employed a systematic search and screening procedure in which 18,590 studies are identified that could potentially address the belief posed. After three levels of screening, 34 studies ultimately qualified. Of those 34 eligible studies, 24 qualified for inclusion in the meta-analysis. They were separated into three groups: lockdown stringency index studies, shelter-in-place-order (SIPO) studies, and specific NPI studies. An analysis of each of these three groups support the conclusion that lockdowns have had little to no effect on COVID-19 mortality. More specifically, stringency index studies find that lockdowns in Europe and the United States only reduced COVID-19 mortality by 0.2% on average. SIPOs were also ineffective, only reducing COVID-19 mortality by 2.9% on average. Specific NPI studies also find no broad-based evidence of noticeable effects on COVID-19 mortality.

While this meta-analysis concludes that lockdowns have had little to no public health effects, they have imposed enormous economic and social costs where they have been adopted. In consequence, lockdown policies are ill-founded and should be rejected as a pandemic policy instrument.

Acknowledgements

Key Words: COVID-19, lockdown, non-pharmaceutical interventions, mortality, systematic review, meta-analysis

JEL Classification: I18; I38; D19

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1 Introduction

The global policy reaction to the COVID-19 pandemic is evident. Compulsory non-pharmaceutical interventions (NPIs), commonly known as "lockdowns" – policies that restrict internal movement, close schools and businesses, and ban international travel – have been mandated in one form or another in almost every country.

The first NPIs were implemented in China. From there, the pandemic and NPIs spread first to Italy and later to virtually all other countries, see Figure 1. Of the 186 countries covered by the Oxford COVID-19 Government Response Tracker (OxCGRT), only Comoros, an island country in the Indian Ocean, did not impose at least one NPI before the end of March 2020.

Figure 1: Share of countries with OxCGRT stringency index above thresholds, January - June 2020
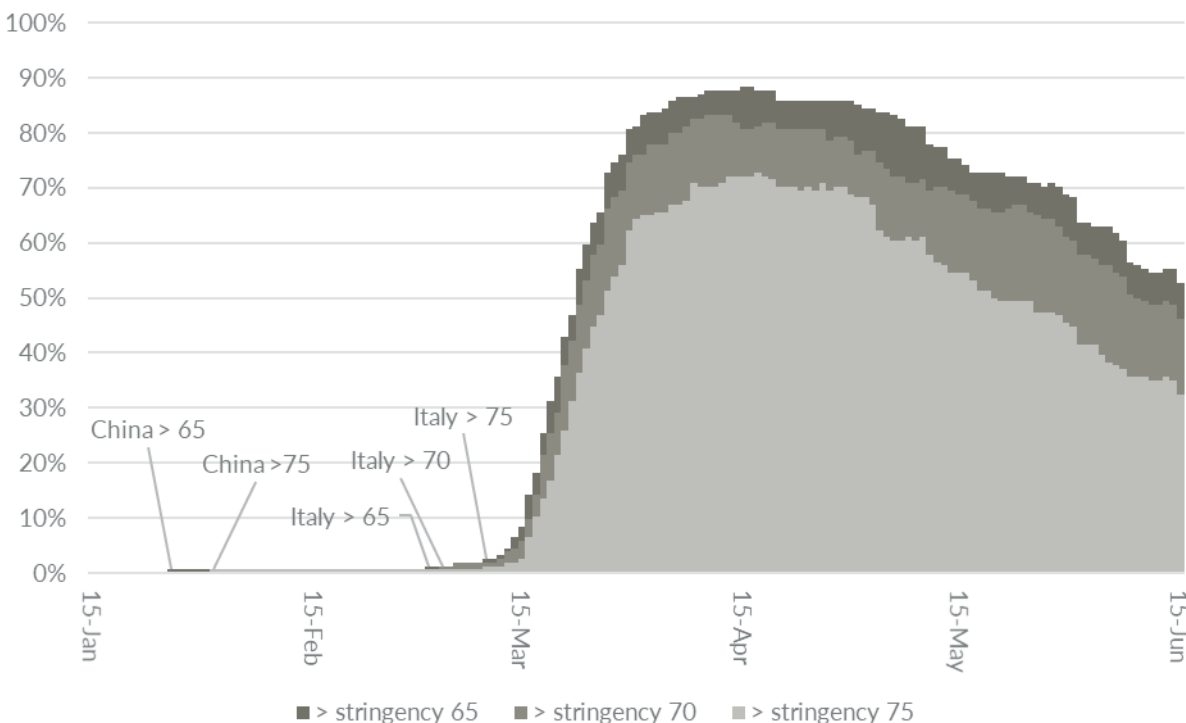
Comment: The figure shows the share of countries, where the OxCGRT stringency index on a given date surpassed index 65, 70 and 75 respectively. Only countries with more than one million citizens are included (153 countries in total). The OxCGRT stringency index records the strictness of NPI policies that restrict people's behavior. It is calculated using all ordinal containment and closure policy indicators (i.e., the degree of school and business closures, etc.), plus an indicator recording public information campaigns.
Source: Our World in Data.

Early epidemiological studies predicted large effects of NPIs. An often cited model simulation study by researchers at the Imperial College London (Ferguson et al. (2020)) predicted that a

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suppression strategy based on a lockdown would reduce COVID-19 mortality by up to 98%.[1] These predictions were questioned by many scholars. Our early interest in the subject was spurred by two studies. First, Atkeson et al. (2020) showed that "across all countries and U.S. states that we study, the growth rates of daily deaths from COVID-19 fell from a wide range of initially high levels to levels close to zero within 20-30 days after each region experienced 25 cumulative deaths." Second, Sebhatu et al. (2020) showed that "government policies are strongly driven by the policies initiated in other countries," and less by the specific COVID-19-situation of the country.

A third factor that motivated our research was the fact that there was no clear negative correlation between the degree of lockdown and fatalities in the spring of 2020 (see Figure 2). Given the large effects predicted by simulation studies such as Ferguson et al. (2020), we would have expected to at least observe a simple negative correlation between COVID-19 mortality and the degree to which lockdowns were imposed.[2]

Figure 2: Correlation between stringency index and COVID-19 mortality in European countries and U.S. states during the first wave in 2020
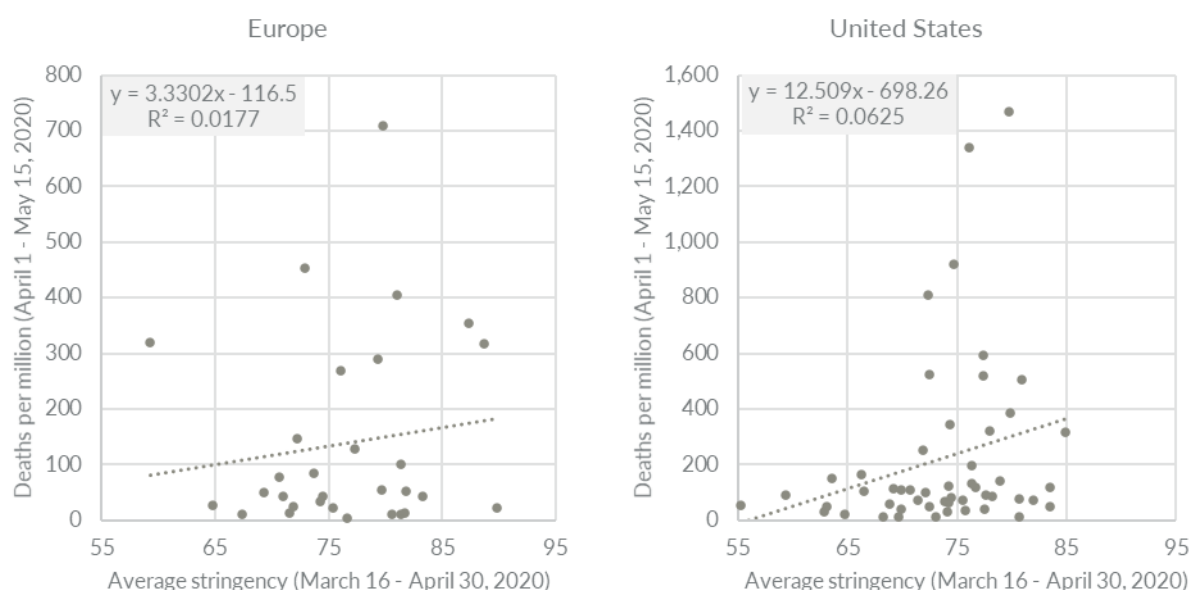
Source: Our World in Data

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[1] With R0 = 2.4 and trigger on 60, the number of COVID-19-deaths in Great Britain could be reduced to 8,700 deaths from 510,000 deaths (-98%) with a policy consisting of case isolation + home quarantine + social distancing + school/university closure, cf. Table 4 in Ferguson et al. (2020). R0 (the basic reproduction rate) is the expected number of cases directly generated by one case in a population where all individuals are susceptible to infection.

[2] In addition, the interest in this issue was sparked by the work Jonung did on the expected economic effects of the SARS pandemic in Europe in 2006 (Jonung and Röger, 2006). In this model-based study calibrated from Spanish flu data, Jonung and Röger concluded that the economic effects of a severe pandemic would be rather limited—a sharp contrast to the huge economic effects associated with lockdowns during the COVID-19 pandemic.

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Today, it remains an open question as to whether lockdowns have had a large, significant effect on COVID-19 mortality. We address this question by evaluating the current academic literature on the relationship between lockdowns and COVID-19 mortality rates.[3] We use "NPI" to describe *any government mandate which directly restrict peoples' possibilities*. Our definition does *not* include governmental recommendations, governmental information campaigns, access to mass testing, voluntary social distancing, etc., but *do* include mandated interventions such as closing schools or businesses, mandated face masks etc. We define *lockdown* as any policy consisting of at least one NPI as described above.[4]

Compared to other reviews such as Herby (2021) and Allen (2021), the main difference in this meta-analysis is that we carry out a systematic and comprehensive search strategy to identify all papers potentially relevant to answer the question we pose. We identify 34 eligible empirical studies that estimate the effect of mandatory lockdowns on COVID-19 mortality using a counterfactual difference-in-difference approach. We present our results in such a way that they can be systematically assessed, replicated, and used to derive overall meta-conclusions.[5]

2 Identification process: Search strategy and eligibility criteria

Figure 3 shows an overview of our identification process using a flow diagram designed according to PRISMA guidelines (Moher et al. (2009). Of 18,590 studies identified during our database searches, 1,048 remained after a title-based screening. Then, 931 studies were excluded, because they either did not measure the effect of lockdowns on mortality or did not use an empirical approach. This left 117 studies that were read and inspected. After a more thorough assessment, 83 of the 117 were excluded, leaving 34 studies eligible for our meta-analysis. A table with all 83 studies excluded in the final step can be found in Appendix B, Table 8.

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[3] We use "mortality" and "mortality rates" interchangeably to mean COVID-19 deaths per population.

[4] For example, we will say that Country A introduced the *non-pharmaceutical interventions* school closures and shelter-in-place-orders as part of the country's *lockdown.*

[5] An interesting question is, "What damage lockdowns do to the economy, personal freedom and rights, and public health in general?" Although this question is important, it requires a full cost-benefit study, which is beyond the scope of this study.

Figure 3: PRISMA flow diagram for the selection of studies.

Identification	18,590 studies identified through extensive database searches (Google Scholar and SCOPUS).	→ ←	Search modified to catch references from identified reviews and dedicated COVID-19 portals (e.g. CEPR's Covid Economics)
Screening	All 18,590 studies screened manually by title (possible related to lockdown and deaths?).	→	17,542 studies excluded
	1,048 studies possible related to lockdown and deaths screened answering "Measures effect of lockdowns on mortality?" & "Uses empirical approach"?	→	931 studies excluded, because the answer is not "yes" to both questions.
Eligibility	117 full-text studies assessed for eligibility	→	83 studies excluded *14 were duplicates* *14 only look at timing* *9 did not look at mortality* *8 used modelling* *1 was purely descriptive* *4 analyzed the effect of social distancing (not lockdowns)* *9 used time series approach* *3 were student papers* *2 did not look at effect of lockdowns* *9 had too few observations* *10 were synthetic control studies*
Included	34 studies included in review		

Below we present our search strategy and eligibility criteria, which follow the PRISMA guidelines and are specified in detail in our protocol Herby et al. (2021).

2.1 Search strategy

The studies we reviewed were identified by scanning *Google Scholar* and *SCOPUS* for English-language studies. We used a wide range of search terms which are combinations of three search strings: a disease search string ("covid," "corona," "coronavirus," "sars-cov-2"), a government

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response search string[6], and a methodology search string[7]. We identified papers based on 1,360 search terms. We also required mentions of "deaths," "death," and/or "mortality." The search terms were continuously updated (by adding relevant terms) to fit this criterion.[8]

We also included all papers published in *Covid Economics*. Our search was performed between July 1 and July 5, 2021 and resulted in 18,590 unique studies.[9] All studies identified using SCOPUS and Covid Economics were also found using Google Scholar. This made us comfortable that including other sources such as VOXeu and SSRN would not change the result. Indeed, many papers found using Google Scholar were from these sources.

All 18,590 studies were first screened based on the title. Studies clearly not related to our research question were deemed irrelevant.[10]

After screening based on the title, 1,048 papers remained. These papers were manually screened by answering two questions:

1. Does the study measure the effect of lockdowns on mortality?
2. Does the study use an empirical *ex post* difference-in-difference approach (see eligibility criteria below)?

Studies to which we could not answer "yes" to both questions were excluded. When in doubt, we made the assessment based on reading the full paper, and in some cases, we consulted with colleagues.[11]

After the manual screening, 117 studies were retrieved for a full, detailed review. These studies were carefully examined, and metadata and empirical results were stored in an Excel

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[6] The government response search string used was: "non-pharmaceutical," "nonpharmaceutical," "NPI," "NPIs," "lockdown," "social distancing orders," "statewide interventions," "distancing interventions," "circuit breaker," "containment measures," "contact restrictions," "social distancing measures," "public health policies," "mobility restrictions," "covid-19 policies," "corona policies," "policy measures."

[7] The methodology search string used was: ("fixed effects," "panel data," "difference-in-difference," "diff-in-diff," "synthetic control," "counterfactual" , "counter factual," "cross country," "cross state," "cross county," "cross region," "cross regional," "cross municipality," "country level," "state level," "county level," "region level," "regional level," "municipality level," "event study."

[8] If a potentially relevant paper from one of the 13 reviews (see eligibility criteria) did not show up in our search, we added relevant words to our search strings and ran the search again. The 13 reviews were: Allen (2021); Brodeur et al. (2021); Gupta et al. (2020); Herby (2021); Johanna et al. (2020); Nussbaumer-Streit et al. (2020); Patel et al. (2020); Perra (2020); Poeschl and Larsen (2021); Pozo-Martin et al. (2020); Rezapour et al. (2021); Robinson (2021); Zhang et al. (2021).

[9] SCOPUS was continuously monitored between July 5th and publication using a search agent. Although the search agent returned several hits during this period, only one of them, An et al. (2021), was eligible according to our eligibility criteria. The study is not included in our review, but the conclusions are in line with our conclusions, as An et al. (2021) conclude that "The analysis shows that the mask mandate is consistently associated with lower infection rates in the short term, and its early adoption boosts the long-term efficacy. By contrast, the other five policy instruments— domestic lockdowns, international travel bans, mass gathering bans, and restaurant and school closures—show weaker efficacy."

[10] This included studies with titles such as "COVID-19 outbreak and air pollution in Iran: A panel VAR analysis" and "Dynamic Structural Impact of the COVID-19 Outbreak on the Stock Market and the Exchange Rate: A Cross-country Analysis Among BRICS Nations."

[11] Professor Christian Bjørnskov of University of Aarhus was particularly helpful in this process.

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spreadsheet. All studies were assessed by at least two researchers. During this process, another 64 papers were excluded because they did not meet our eligibility criteria. Furthermore, nine studies with too little jurisdictional variance (< 10 observations) were excluded,[12] and 10 synthetic control studies were excluded.[13] A table with all 83 studies excluded in the final step can be found in Appendix B, Table 8. Below we explain why these studies are excluded.

2.2 Eligibility criteria

Focus on mortality and lockdowns

We only include studies that attempt to establish a relationship (or lack thereof) between lockdown policies and COVID-19 mortality or excess mortality. We exclude studies that use cases, hospitalizations, or other measures.[14]

Counterfactual difference-in-difference approach

We distinguish between two methods used to establish a relationship (or lack thereof) between mortality rates and lockdown policies. The first uses registered cross-sectional mortality data. These are *ex post* studies. The second method uses simulated data on mortality and infection rates.[15] These are *ex ante* studies.

We include all studies using a counterfactual difference-in-difference approach from the former group but disregard all *ex ante* studies, as the results from these studies are determined by model assumptions and calibrations.

Our limitation to studies using a "counterfactual difference-in-difference approach" means that we exclude all studies where the counterfactual is based on forecasting (such as a SIR-model) rather than derived from a difference-in-difference approach. This excludes studies like Duchemin et al. (2020) and Matzinger and Skinner (2020). We also exclude all studies based on interrupted time series designs that simply compare the situation before and after lockdown, as

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[12]The excluded studies with too few observations were: Alemán et al. (2020), Berardi et al. (2020), Conyon et al. (2020a), Coccia (2021), Gordon et al. (2020), Juranek and Zoutman (2021), Kapoor and Ravi (2020), Umer and Khan (2020), and Wu and Wu (2020).

[13] The excluded synthetic control studies were: Conyon and Thomsen (2021), Dave et al. (2020), Ghosh et al. (2020), Born et al. (2021), Reinbold (2021), Cho (2020), Friedson et al. (2021), Neidhöfer and Neidhöfer (2020), Cerqueti et al. (2021), and Mader and Rüttenauer (2021).

[14] Analyses based on cases may pose major problems, as testing strategies for COVID-19 infections vary enormously across countries (and even over time within a given country). In consequence, cross-country comparisons of cases are, at best, problematic. Although these problems exist with death tolls as well, they are far more limited. Also, while cases and death tolls are correlated, there may be adverse effects of lockdowns that are not captured by the number of cases. For example, an infected person who is isolated at home with family under a SIPO may infect family members with a higher viral load causing more severe illness. So even if a SIPO reduces the number of cases, it may theoretically increase the number of COVID-19-deaths. Adverse effects like this may explain why studies like Chernozhukov et al. (2021) finds that SIPO reduces the number of cases but have no significant effect on the number of COVID-19-deaths. Finally, mortality is hierarchically the most important outcome, cf. GRADEpro (2013)

[15] These simulations are often made in variants of the SIR-model, which can simulate the progress of a pandemic in a population consisting of people in different states (Susceptible, Infectious, or Recovered) with equations describing the process between these states.

the effect of lockdowns in these studies might contain time-dependent shifts, such as seasonality. This excludes studies like Bakolis et al. (2021) and Siedner et al. (2020).

Given our criteria, we exclude the much-cited paper by Flaxman et al. (2020), which claimed that lockdowns saved three million lives in Europe. Flaxman et al. assume that the pandemic would follow an epidemiological curve unless countries locked down. However, this assumption means that the only interpretation possible for the empirical results is that lockdowns are the only thing that matters, even if other factors like season, behavior etc. caused the observed change in the reproduction rate, Rt. Flaxman et al. are aware of this and state that "our parametric form of R_t assumes that changes in Rt are an immediate response to interventions rather than gradual changes in behavior." Flaxman et al. illustrate how problematic it is to force data to fit a certain model if you want to infer the effect of lockdowns on COVID-19 mortality.[16]

The counterfactual difference-in-difference studies in this review generally exploit variation across countries, U.S. states, or other geographical jurisdictions to infer the effect of lockdowns on COVID-19 fatalities. Preferably, the effect of lockdowns should be tested using randomized control trials, natural experiments, or the like. However, there are very few studies of this type.[17]

Synthetic control studies
The synthetic control method is a statistical method used to evaluate the effect of an intervention in comparative case studies. It involves the construction of a synthetic control which functions as the counter factual and is constructed as an (optimal) weighted combination of a pool of donors. For example, Born et al. (2021) create a synthetic control for Sweden which consists of 30.0% Denmark, 25.3% Finland, 25.8% Netherlands, 15.0% Norway, and 3.9% Sweden. The effect of the intervention is derived by comparing the actual developments to those contained in the synthetic control.

We exclude synthetic control studies because of their inherent empirical problems as discussed by Bjørnskov (2021b). He finds that the synthetic control version of Sweden in Born et al. (2021) deviates substantially from "actual Sweden," when looking at the period before mid-March 2020, when Sweden decided not to lock down. Bjørnskov estimates that *actual Sweden* experienced

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[16] Several scholars have criticized Flaxman et al. (2020), e.g. see Homburg and Kuhbandner (2020), Lewis (2020), and Lemoine (2020).

[17] Kepp and Bjørnskov (2021) is one such study. They use evidence from a quasi-natural experiment in the Danish region of Northern Jutland. After the discovery of mutations of Sars-CoV-2 in mink – a major Danish export – seven of the 11 municipalities of the region went into extreme lockdown in early November, while the four other municipalities retained the moderate restrictions of the remaining country. Their analysis shows that while infection levels decreased, they did so before lockdown was in effect, and infection numbers also decreased in neighbor municipalities without mandates. They conclude that efficient infection surveillance and voluntary compliance make full lockdowns unnecessary, at least in some circumstances. Kepp and Bjørnskov (2021) is not included in our review, because they focus on cases and not COVID-19 mortality. Dave et al. (2020) is another such study. They see the Wisconsin Supreme Court abolishment of Wisconsin's "Safer at Home" order (a SIPO) as a natural experiment and find that "the repeal of the state SIPO impacted social distancing, COVID-19 cases, or COVID-19-related mortality during the fortnight following enactment." Dave et al. (2020) is not included in our review, because they use a synthetic control method.

approximately 500 fewer deaths the first 11 weeks of 2020 and 4,500 fewer deaths in 2019 compared to *synthetic Sweden.*

This problem is inherent in all synthetic control studies of COVID-19, Bjørnskov argues, because the synthetic control should be fitted based on a long period of time before the intervention or the event one is studying the consequences of – i.e., the lockdown Abadie (2021). However, this is not possible for the coronavirus pandemic, as there clearly *is* no long period with coronavirus before the lockdown. Hence, the synthetic control study approach is *by design* not appropriate for studying the effect of lockdowns.

Jurisdictional variance - few observations
We exclude all interrupted time series studies which simply compare mortality rates before and after lockdowns. Simply comparing data from before and after the imposition of lockdowns could be the result of time-dependent variations, such as seasonal effects. For the same reason, we also exclude studies with little jurisdictional variance.[18] For example, we exclude Conyon et al. (2020b) who "exploit policy variation between Denmark and Norway on the one hand and Sweden on the other" and, thus, only have one jurisdictional area in the control group. Although this *is* a difference-in-difference approach, there is a non-negligible risk that differences are caused by much more than just differences in lockdowns. Another example is Wu and Wu (2020), who use all U.S. states, but pool groups of states so they end with basically three observations. None of the excluded studies cover more than 10 jurisdictional areas.[19] One study is a special case of the jurisdictional variance criteria (Auger et al. (2020). Those researchers analyze the effect of school closures in U.S. states and find that those closures reduce mortality by 35%. However, all 50 states closed schools between March 13, 2020, and March 23, 2020, which means that all difference-in-difference is based on maximum 10 days. Given the long lag between infection and death, there is a risk that Auger et al.'s approach is an interrupted time series analysis where they compare United States before and after school closures, rather than a true difference-in-difference approach. However, we choose to include this study, as it is eligible under our protocol Herby et al. (2021).

Publication status and date
We include all *ex post* studies regardless of publication status and date. That is, we cover both working papers and papers published in journals. We include the early papers because the knowledge of the COVID-19-pandemic grew rapidly in the beginning, making later papers able to stand on the shoulders of previous work. Also, in the early days of COVID-19, speed was

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[18] A jurisdictional area can be countries, U.S. states, or counties. With "jurisdictional variance" we refer to variation in mandates across jurisdictional areas.
[19] All studies excluded on this criterion are listed in footnote 12.

crucial which may have affected the quality of the papers. Including them makes it possible to compare the results of early studies to studies carried out at a later stage.[20]

The role of optimal timing
We exclude papers which analyze the effect of early lockdowns in contrast to later lockdowns. There's no doubt that being prepared for a pandemic and knowing when it arrives at your doorstep is vital. However, at least two problems arise with respect to evaluating the effect of well-timed lockdowns.

First, when COVID-19 hit Europe and the United States, it was virtually impossible to determine the right timing. The World Health Organization declared the outbreak a pandemic on March 11, 2020, but at that date, Italy had already registered 13.7 COVID-19 deaths per million. On March 29, 2020, 18 days after the WHO declared the outbreak a pandemic and the earliest a lockdown response to the WHO's announcement could potentially have an effect, the mortality rate in Italy was a staggering 178 COVID-19 deaths per million with an additional 13 per million dying each day.[21]

Secondly, it is extremely difficult to differentiate between the effect of public awareness and the effect of lockdowns when looking at timing because people and politicians are likely to react to the same information. As Figure 4 illustrates, all European countries and U.S. states that were hit hard and early by COVID-19 experienced high mortality rates, whereas all countries hit relatively late experienced low mortality rates. Björk et al. (2021) illustrate the difficulties in analyzing the effect of timing. They find that a 10-stringency-points-stricter lockdown would reduce COVID-19 mortality by a total of 200 deaths per million[22] if done in week 11, 2020, but would only have approximately 1/3 of the effect if implemented one week earlier or later and no effect if implemented three weeks earlier or later. One interpretation of this result is that lockdowns do not work if people either find them unnecessary and fail to obey the mandates or if people voluntarily lock themselves down. This is the argument Allen (2021) uses for the ineffectiveness of the lockdowns he identifies. If this interpretation is true, what Björk et al. (2021) find is that information and signaling is far more important than the strictness of the lockdown. There may be other interpretations, but the point is that studies focusing on timing cannot differentiate between these interpretations. However, if lockdowns have a notable effect, we should see this effect regardless of the timing, and we should identify this effect more correctly by excluding studies that exclusively analyze timing.

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[20] We also intended to exclude studies which were primarily based on data from 2021 (as these studies would be heavily affected by vaccines) and studies that did not cover at least one EU-country, the United States, one U.S. U.S. state or Latin America, and where at least one country/state was not an island. However, we did not find any such studies.

[21] There's approximately a two-to-four-week gap between infection and deaths. See footnote 29.

[22] They estimate that 10-point higher stringency will reduce excess mortality by 20 "per week and million" in the 10 weeks from week 14 to week 23.

Figure 4: **Taken by surprise. The importance of having time to prepare**
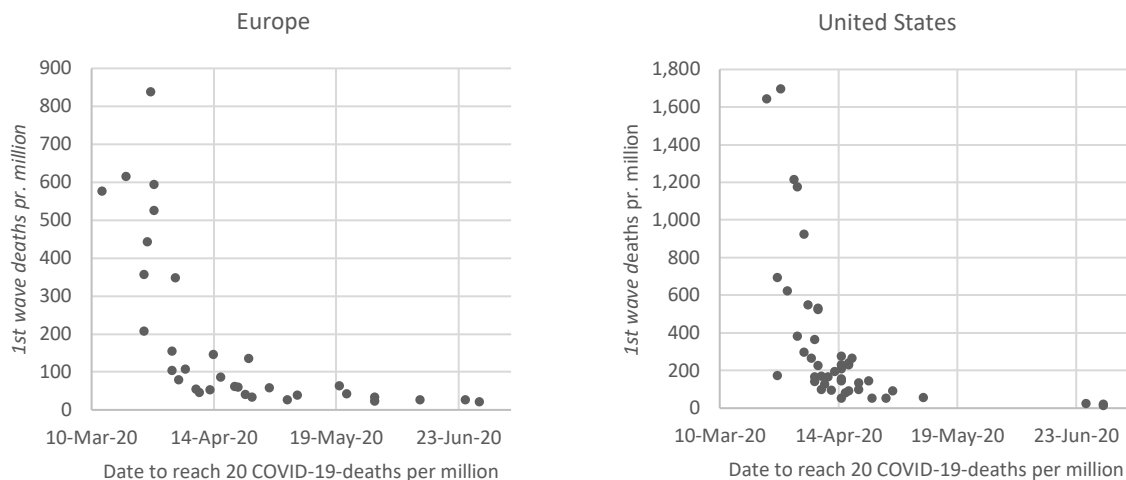
Comment: The figure shows the relationship between early pandemic strength and total 1ˢᵗ wave of COVID-19 death toll. On the X-axis is "Days to reach 20 COVID-19-deaths per million (measured from February 15, 2020)." The Y-axis shows mortality (deaths per million) by June 30, 2020.
Source: Reported COVID-19 deaths and OxCGRT stringency for European countries and U.S. states with more than one million citizens. Data from Our World in Data.

We are aware of one meta-analysis by Stephens et al. (2020), which looks into the importance of timing. The authors find 22 studies that look at policy and timing with respect to mortality rates, however, only four were multi-country, multi-policy studies, which could possibly account for the problems described above. Stephens et al. conclude that "the timing of policy interventions across countries relative to the first Wuhan case, first national disease case, or first national death, is not found to be correlated with mortality." (See Appendix A for further discussion of the role of timing.)

3   The empirical evidence

In this section we present the empirical evidence found through our identification process. We describe the studies and their results, but also comment on the methodology and possible identification problems or biases.

3.1   Preliminary considerations

Before we turn to the eligible studies, we present some considerations that we adopted when interpreting the empirical evidence.

Empirical interpretation
While the policy conclusions contained in some studies are based on statistically significant results, many of these conclusions are ill-founded due to the tiny impact associated with said statistically significant results. For example, Ashraf (2020) states that "social distancing

<div style="text-align:center">12</div>

measures has proved effective in controlling the spread of [a] highly contagious virus." However, their estimates show that the average lockdown in Europe and the U.S only reduced COVID-19 mortality by 2.4%.[23] Another example is Chisadza et al. (2021). The authors argue that "less stringent interventions increase the number of deaths, whereas more severe responses to the pandemic can lower fatalities." Their conclusion is based on a negative estimate for the squared term of *stringency* which results in a total negative effect on mortality rates (i.e. fewer deaths) for stringency values larger than 124. However, the stringency index is limited to values between 0 and 100 by design, so the conclusion is clearly incorrect. To avoid any such biases, we base our interpretations solely on the empirical estimates and not on the authors' own interpretation of their results.

Handling multiple models, specifications, and uncertainties
Several studies adopt a number of models to understand the effect of lockdowns. For example, Bjørnskov (2021a) estimates the effect after one, two, three, and four weeks of lockdowns. For these studies, we select the longest time horizon analyzed to obtain the estimate closest to the long-term effect of lockdowns.

Several studies also use multiple specifications including and excluding potentially relevant variables. For these studies, we choose the model which the authors regard as their main specification. Finally, some studies have multiple models which the authors regard as equally important. One interesting example is Chernozhukov et al. (2021), who estimate two models with and without national case numbers as a variable. They show that including this variable in their model alters the results substantially. The explanation could be that people responded to national conditions. For these studies, we present both estimates in Table 1, but – following Doucouliagos and Paldam (2008) – we use an average of the estimates in our meta-analysis in order to not give more weight to a study with multiple models relative to studies with just one principal model.

For studies looking at different classes of countries (e.g. rich and poor), we report both estimates in Table 1 but use the estimate for rich Western countries in our meta-analysis, where we derive common estimates for Europe and the United States.

Effects are measured "relative to Sweden in the spring of 2020"
Virtually all countries in the world implemented mandated NPIs in response to the COVID-19 pandemic. Hence, most estimates are relative to "doing the least," which in many Western countries means relative to doing as Sweden has done, especially during the first wave, when Sweden, do to constitutional constraints, implemented very few restrictions compared to other western countries (Jonung and Hanke 2020). However, some studies *do* compare the effect of doing something to the effect of doing absolutely nothing (e.g. Bonardi et al. (2020)).

The consequence is that some estimates are relative to "doing the least" while others are relative to "doing nothing." This may lead to biases if "doing the least" works as a signal (or warning)

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[23] We describe how we arrive at the 2.4% in Section 4.

which alters the behavior of the public. For example, Gupta et al. (2020) find a large effect of emergency declarations, which they argue "are best viewed as an information instrument that signals to the population that the public health situation is serious and they act accordingly," on social distancing but not of other policies such as SIPOs (shelter-in-place orders). Thus, if we compare a country issuing a SIPO to a country doing nothing, we may overestimate the effect of a SIPO, because it is the sum of the signal *and* the SIPO. Instead, we should compare the country issuing the SIPO to a country "doing the least" to estimate the *marginal* effect of the SIPO.

To take an example, Bonardi et al. (2020) find relatively large effects of doing *something* but no effect of doing *more*. They find no extra effect of stricter lockdowns relative to less strict lockdowns and state that "our results point to the fact that people might adjust their behaviors quite significantly as partial measures are implemented, which might be enough to stop the spread of the virus." Hence, whether the baseline is Sweden, which implemented a ban on large gatherings early in the pandemic, or the baseline is "doing nothing" can affect the magnitude of the estimated impacts. There is no obvious right way to resolve this issue, but since estimates in most studies are relative to doing less, we report results as compared to "doing less" when available. Hence, for Bonardi et al. we state that the effect of lockdowns is zero (compared to Sweden's "doing the least").

3.2   Overview of the findings of eligible studies

Table 1 covers the 34 studies eligible for our review.[24] Out of these 34 studies, 22 were peer-reviewed and 12 were working papers. The studies analyze lockdowns during the first wave. Most of the studies (29) use data collected before September 1st, 2020 and 10 use data collected before May 1st, 2020. Only one study uses data from 2021. All studies are cross-sectional, ranging across jurisdictions. Geographically, 14 studies cover countries worldwide, four cover European countries, 13 cover the United States, two cover Europe and the United States, and one covers regions in Italy. Seven studies analyze the effect of SIPOs, 10 analyze the effect of stricter lockdowns (measured by the OxCGRT stringency index), 16 studies analyze specific NIP's independently, and one study analyzes other measures (length of lockdown).

Several studies find no statistically significant effect of lockdowns on mortality. For example, this includes Bjørnskov (2021a) and Stockenhuber (2020) who find no significant effect of stricter lockdowns (higher OxCGRT stringency index), Sears et al. (2020) and Dave et al. (2021), who find no significant effect of SIPOs, and Chaudhry et al. (2020), Aparicio and Grossbard (2021) and Guo et al. (2021) who find no significant effect of any of the analyzed NIP's, including business closures, school closures and border closures.

Other studies find a significant negative relationship between lockdowns and mortality. Fowler et al. (2021 find that SIPOs reduce COVID-19 mortality by 35%, while Chernozhukov et al.

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[24] The following information can be found for each study in Table 2.

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(2021) find that employee mask mandates reduces mortality by 34% and closing businesses and bars reduces mortality by 29%.

Some studies find a significant positive relationship between lockdowns and mortality. This includes Chisadza et al. (2021), who find that stricter lockdowns (higher OxCGRT stringency index) increases COVID-19 mortality by 0.01 deaths/million per stringency point and Berry et al. (2021), who find that SIPOs increase COVID-19 mortality by 1% after 14 days.

Most studies use the number of official COVID-19 deaths as the dependent variable. Only one study, Bjørnskov (2021a), looks at total excess mortality which – although is not perfect – we perceive to be the best measure, as it overcomes the measurement problems related to properly reporting COVID-19 deaths.

Several studies explicitly claim that they estimate the actual causal relationship between lockdowns and COVID-19 mortality. Some studies use instrumental variables to justify the causality associated with their analysis, while others make causality probable using anecdotal evidence.[25] But, Sebhatu et al. (2020) show that government policies are strongly driven by the policies initiated in neighboring countries rather than by the severity of the pandemic in their own countries. In short, it is not the severity of the pandemic that drives the adoption of lockdowns, but rather the propensity to copy policies initiated by neighboring countries. The Sebhatu et al. conclusion throws into doubt the notion of a causal relationship between lockdowns and COVID-19 mortality.

Table 1: Summary of eligible studies

1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
Alderman and Harjoto (2020); "COVID-19: U.S. shelter-in-place orders and demographic characteristics linked to cases, mortality, and recovery rates"	COVID-19 mortality	Use State-level data from the COVID-19 Tracking Project data all U.S. states, and a multivariate regression analysis to empirically investigate the impacts of the duration of shelter-in-place orders on mortality.	Find that shelter-in-place orders are - for the average duration - associated with 1% (insignificant) fewer deaths per capita.	
Aparicio and Grossbard (2021); "Are Covid Fatalities in the U.S. Higher than in the EU, and If so, Why?"	COVID-19 mortality	Their main focus is to explain the gap in COVID-19-fatalities between Europe and the United States based on COVID-deaths and other data from 85 nations/states. They include status for "social events" (ban on public gatherings, cancellation of major events and conferences), school closures, shop closures "partial lockdowns" (e.g. night curfew) and "lockdowns" (all-day curfew) 100 days after the pandemic onset in a country/state. None of these interventions have a significant effect on COVID-19 mortality. They also find no	Find no effect of "social events" (ban on public gatherings, cancellation of major events and conferences), school closures, shop closures "partial lockdowns" (e.g. night curfew) and "lockdowns" (all-day curfew) 100 days after the pandemic onset.	In the abstract the authors states that "various types of social distance measures such as school closings and lockdowns, and how soon they were implemented, help explain the U.S./EUROPE gap in cumulative deaths measured 100 days after the pandemic's onset in a state or country" although their estimates are insignificant.

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[25] E.g. Dave et al. (2021) states that "estimated case reductions accelerate over time, becoming largest after 20 days following enactment of a SIPO. These findings are consistent with a causal interpretation."

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1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
		significant effect of early cancelling of social events, school closures, shop closures, partial lockdowns and full lockdowns.		
Ashraf (2020); "Socioeconomic conditions, government interventions and health outcomes during COVID-19"	COVID-19 mortality	Their main focus is on the effectiveness of policies targeted to diminish the effect of socioeconomic inequalities (economic support) on COVID-19-deaths. They use data from 80 countries worldwide and include the OxCGRT stringency as a control variable in their models. The paper finds a significant negative (fewer deaths) effect of stricter lockdowns. The effect of lockdowns is insignificant, when they include an interaction term between the socioeconomic conditions index and the economic support index in their model.	For each 1-unit increase in OxCGRT stringency index, the cumulative mortality changes by -0.326 deaths per million (fewer deaths). The estimate is -0.073 deaths per million but insignificant, when including an interaction term between the socioeconomic conditions index and the economic support index.	
Auger et al. (2020); "Association between statewide school closure and COVID-19 incidence and mortality in the U.S."	COVID-19 mortality	U.S. population-based observational study which uses interrupted time series analyses incorporating a lag period to allow for potential policy-associated changes to occur. To isolate the association of school closure with outcomes, state-level nonpharmaceutical interventions and attributes were included in negative binomial regression models. Models were used to derive the estimated absolute differences between schools that closed and schools that remained open. The main outcome of the study is COVID-19 daily incidence and mortality per 100000 residents.	State that they adjust for several factors (e..g percentage of state's population aged 15 years and 65 years, CDC's social vulnerability index, stay-at-home or shelter-in-place order, restaurant and bar closure, testing rate per 1000 residents etc.), but does not specify how and do not present estimates.	All 50 states closed schools between March 13, 2020, and March 23, 2020. Hence, all difference-in-difference is based on maximum 10 days, and given the long lag between infection and death, there is a risk that their approach is more an interrupted time series analysis, where they compare United States before and after school closures, rather than a true difference-in-difference approach. However, we choose to include the study in our review as it - objectively speaking - lives up to the eligibility criteria specified in our protocol.
Berry et al. (2021); "Evaluating the effects of shelter-in-place policies during the COVID-19 pandemic"	COVID-19 mortality	The authors use U.S. county data on COVID-19 deaths from Johns Hopkin and SIPO data from the University of Washington to estimate the effect of SIPO's. They find no detectable effects of SIPO on deaths. The authors stress that their findings should not be interpreted as evidence that social distancing behaviors are not effective. Many people had already changed their behaviors before the introduction of shelter-in-place orders, and shelter-in-place orders appear to have been ineffective precisely because they did not meaningfully alter social distancing behavior.	SIPO increases the number of deaths by 0,654 per million after 14 days (see Fig. 2)	The authors conclude that "We do not find detectable effects of these policies [SIPO] on disease spread or deaths." However, this statement does not correspond to their results. In figure 2 they show that the effect on deaths is significant after 14 days. Looks at the effect 14 days after SIPO's are implemented which is a short lag given that the time between infection and deaths is at least 2-3 weeks.
Bjørnskov (2021a); "Did Lockdown Work? An Economist's Cross-Country Comparison"	Excess mortality	Uses excess mortality and OxCGRT stringency from 24 European countries to estimate the effect of lockdown on the number of deaths one, two, three and four weeks later. Finds no effect (negative but insignificant) of (stricter) lockdowns. The author's specification using instrument variables yields similar results.	A stricter lockdown (OxCGRT stringency) does not have a significant effect on excess mortality.	Finds a positive (more deaths) effect after one and two weeks, which could indicate that other factors (omitted variables) affect the results.
Blanco et al. (2020); "Do Coronavirus Containment Measures Work? Worldwide Evidence"	COVID-19 mortality	Use data for deaths and NPIs from Hale et al. (2020) covering 158 countries between January and August 2020 to evaluate the effect of eight different NPIs (stay at home, bans on gatherings, bans on public	When using the naïve dummy variable approach, all parameters are statistically	Run the same model four times for each of the different NPIs (stay at home-orders, ban on meetings, ban on public events and mobility restrictions). These NPIs were often introduced almost simultaneously so there is a high risk of

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1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
		events, closing schools, lockdowns of workplaces, interruption of public transportation services, and international border closures. They address the possible endogeneity of the NPIs by using instrumental variables.	insignificant. On the contrary, estimates using the instrumental variable approach indicate that NPIs are effective in reducing the growth rate in the daily number of deaths 14 days later.	multicollinearity with each run capturing the same underlying effect. Indeed, the size and standard errors of the estimates are worryingly similar. Looks at the effect 14 days after NPIs are implemented which is a fairly short lag given the time between infection and deaths is 2-3 weeks, cf. e.g. Flaxman et al. (2020), which according to Bjørnskov (2020) appears to be the minimum typical time from infection to death).
Bonardi et al. (2020); "Fast and local: How did lockdown policies affect the spread and severity of the covid-19"	Growth rates	Use NPI data scraped from news headlines from LexisNexis and death data from Johns Hopkins University up to April 1st 2020 in a panel structure with 184 countries. Controls for country fixed effects, day fixed effects and within-country evolution of the disease.	Find that certain interventions (SIPO, regional lockdown and partial lockdown) work (in developed countries), but that stricter interventions (SIPO) do not have a larger effect than less strict interventions (e.g. restrictions on gatherings). Find no effect of border closures.	Find a positive (more deaths) effect on day 1 after lockdown which may indicate that their results are driven by other factors (omitted variables). We rely on their publicly available version submitted to CEPR Covid Economics, but estimates on the effect of deaths can be found in Supplementary material, which is available in an updated version hosted on the Danish Broadcasting Corporation's webpage: https://www.dr.dk/static/documents/2021/03/04/managing_pandemics_e3911c11.pdf
Bongaerts et al. (2021); "Closed for business: The mortality impact of business closures during the Covid-19 pandemic"	COVID-19 mortality	Uses variation in exposure to closed sectors (e.g. tourism) in municipalities within Italy to estimate the effect of business closures. Assuming that municipalities with different exposures to closed sectors are not inherently different, they find that municipalities with higher exposure to closed sectors experienced subsequently lower mortality rates.	Business shutdown saved 9,439 Italian lives by April 13th 2020. This corresponds to a reduction of deaths by 32%, as there were 20,465 COVID-19-deaths in Italy by mid April 2020.	They (implicitly) assume that municipalities with different exposures to closed sectors are not inherently different. This assumption could be problematic, as more touristed municipalities can be very different from e.g. more industrialized municipalities.
Chaudhry et al. (2020); "A country level analysis measuring the impact of government actions, country preparedness and socioeconomic factors on COVID-19 mortality and related health outcomes"	COVID-19 mortality	Uses information on COVID-19 related national policies and health outcomes from the top 50 countries ranked by number of cases. Finds no significant effect of any NPI on the number of COVID-19-deaths.	Finds no significant effect on mortality of any of the analyzed interventions (partial border closure, complete border closure, partial lockdown (physical distancing measures only), complete lockdown (enhanced containment measures including suspension of all non-essential services), and curfews).	
Chernozhukov et al. (2021); "Causal impact of masks, policies, behavior on early covid-19 pandemic in the U.S."	Growth rates	Uses COVID-deaths from the New York Times and Johns Hopkins and data for U.S. States from Raifman et al. (2020) to estimate the effect of SIPO, closed nonessential businesses, closed K-12 schools, closed restaurants except takeout, closed movie theaters, and face mask mandates for employees in public facing businesses.	Finds that mandatory masks for employees and closing K-12 schools reduces deaths. SIPO and closing business (average of closed businesses, restaurants and movie theaters) has no statistically significant effect. The effect of school closures is highly sensitive to the	States that "our regression specification for case and death growths is explicitly guided by a SIR model although our causal approach does not hinge on the validity of a SIR model." We are uncertain if this means that data are managed to fit an SIR-model (and thus should fail our eligibility criteria).

1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
			inclusion of national case and death data.	
Chisadza et al. (2021); "Government Effectiveness and the COVID-19 Pandemic"	COVID-19 mortality	Uses COVID-19-deaths and OxCGRT stringency from 144 countries to estimate the effect of lockdown on the number of COVID-19-deaths. Find a significant positive (more deaths) non-linear association between government response indices and the number of deaths.	An increase by 1 on "stringency index" increases the number of deaths by 0.0130 per million. The sign of the squared term is negative, but the combined non-linear estimate is positive (increases deaths) and larger than the linear estimate for all values of the OxCGRT stringency index.	The author states that "less stringent interventions increase the number of deaths, whereas more severe responses to the pandemic can lower fatalities." However, according to their estimates this is not correct, as the combined non-linear estimate cannot be negative for relevant values of the OxCGRT stringency index (0 to 100).
Dave et al. (2021); "When Do Shelter-in-Place Orders Fight Covid-19 Best? Policy Heterogeneity Across States and Adoption Time"	COVID-19 mortality	Uses smartphone location tracking and state data on COVID-19 deaths and SIPO data (supplemented by their own searches) collected by the New York Times to estimate the effect of SIPO's. Finds that SIPO was associated with a 9%–10% increase in the rate at which state residents remained in their homes full-time, but overall they do not find an significant effect on mortality after 20+ days (see Figure 4). Indicate that the lacking significance may be due to long term estimates being identified of a few early adopting states.	Finds no overall significant effect of SIPO on deaths but does find a negative effect (fewer deaths) in early adopting states.	Find large effects of SIPO on deaths after 6-14 days in early adopting states (see Table 8), which is before an SIPO-related effect would be seen. This could indicate that other factors rather than SIPO's drive the results.
Dergiades et al. (2020); "Effectiveness of government policies in response to the COVID-19 outbreak"	COVID-19 mortality	Uses daily deaths from the European Centre for Disease Prevention and Control and OxCGRT stringency from 32 countries worldwide (including U.S.) to estimates the effect of lockdown on the number of deaths.	Finds that the greater the strength of government interventions at an early stage, the more effective these are in slowing down or reversing the growth rate of deaths.	Focus is on the effect of early stage NPIs and thus does not absolutely live up to our eligibility criteria. However, we include the study as it differentiates between lockdown strength at an early stage.
Fakir and Bharati (2021); "Pandemic catch-22: The role of mobility restrictions and institutional inequalities in halting the spread of COVID-19"	COVID-19 mortality	Uses data from 127 countries. combining high-frequency measures of mobility data from Google's daily mobility reports, country-date-level information on the stringency of restrictions in response to the pandemic from Oxford's Coronavirus Government Response Tracker (OxCGRT), and daily data on deaths attributed to COVID-19 from Our World In Data and the Johns Hopkins University. Instrument stringency using day-to-day changes in the stringency of the restrictions in the rest of the world.	Find large causal effects of stricter restrictions on the weekly growth rate of recorded deaths attributed to COVID-19. Show that more stringent interventions help more in richer, more educated, more democratic, and less corrupt countries with older, healthier populations and more effective governments.	Finds a larger effect on deaths after 0 days than after 14 and 21 days (Table 3). This is surprising given that it takes 2-3 weeks from infection to death, and it may indicate that their results are driven by other factors.
Fowler et al. (2021); "Stay-at-home orders associate with subsequent decreases in COVID-19 cases and fatalities in the United States"	COVID-19 mortality	Uses U.S. county data on COVID-19 deaths and SIPO data collected by the New York Times to estimate the effect of SIPO's using a two-way fixed-effects difference-in-differences model. Find a large and early (after few days) effect of SIPO on COVID-19 related deaths.	Stay-at-home orders are also associated with a 59.8 percent (18.3 to 80.2) average reduction in weekly fatalities after three weeks. These results suggest that stay-at-home orders	Finds the largest effect of SIPO on deaths after 10 days (see Figure 4), before a SIPO-related effect could possibly be seen as it takes 2-3 weeks from infection to death. This could indicate that other factors drive their results.

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1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
			might have reduced confirmed cases by 390,000 (170,000 to 680,000) and fatalities by 41,000 (27,000 to 59,000) within the first three weeks in localities that implemented stay-at-home orders.	
Fuller et al. (2021); "Mitigation Policies and COVID-19–Associated Mortality — 37 European Countries, January 23–June 30, 2020"	COVID-19 mortality	Uses COVID-19-deaths and OxCGRT stringency in 37 European countries to estimate the effect of lockdown on the number of COVID-19-deaths. Find a significant negative (fewer deaths) effect of stricter lockdowns after mortality threshold is reached (the threshold is a daily rate of 0.02 new COVID-19 deaths per 100,000 population (based on a 7-day moving average))	For each 1-unit increase in OxCGRT stringency index, the cumulative mortality decreases by 0.55 deaths per 100,000.	
Gibson (2020); "Government mandated lockdowns do not reduce Covid-19 deaths: implications for evaluating the stringent New Zealand response"	COVID-19 mortality	Uses data for every county in the United States from March through June 1, 2020, to estimate the effect of SIPO (called "lockdown") on COVID-19 mortality. Policy data are acquired from American Red Cross reporting on emergency regulations. His control variables include county population and density, the elder share, the share in nursing homes, nine other demographic and economic characteristics and a set of regional fixed effects. Handles causality problems using instrument variables (IV).	Find no statistically significant effect of SIPO.	Gibson use the word "lockdown" as synonym for SIPO (writes "technically, government-ordered community quarantine")
Goldstein et al. (2021); "Lockdown Fatigue: The Diminishing Effects of Quarantines on the Spread of COVID-19 "	COVID-19 mortality	Uses panel data from 152 countries with data from the onset of the pandemic until December 31, 2020. Finds that lockdowns tend to reduce the number of COVID-19 related deaths, but also that this benign impact declines over time: after four months of strict lockdown, NPIs have a significantly weaker contribution in terms of their effect in reducing COVID-19 related fatalities.	Stricter lockdowns reduce deaths for the first 60 days, whereafter the cumulative effect begins to decrease. If reintroduced after 120, the effect of lockdowns is smaller in the short run, but after 90 days the effect is almost the same as during first lockdown (only app. 10% lower).	There is little documentation in the study (e.g. no tables with estimates).
Guo et al. (2021); "Mitigation Interventions in the United States: An Exploratory Investigation of Determinants and Impacts"	COVID-19 mortality	Uses policy data from 1,470 executive orders from the state–government websites for all 50 states and Washington DC and COVID-19-deaths from Johns Hopkins University in a random-effect spatial error panel model to estimate the effect of nine NPIs (SIPO, strengthened SIPO, public school closure, all school closure, large-gathering ban of more than 10 people, any gathering ban, restaurant/bar limit to dining out only, nonessential business closure, and mandatory self-quarantine of travelers) on COVID-19 deaths.	Two mitigation strategies (all school closure and mandatory self-quarantine of travelers) showed positive (more deaths) impact on COVID-19-deaths per 10,000. Six mitigation strategies (SIPO, public school closure, large gathering bans (>10), any gathering ban, restaurant/bar limit to dining out only, and nonessential business	Only conclude on NPIs which reduce mortality. However, the conclusion is based on one-tailed tests, which means that all positive estimates (more deaths) are deemed insignificant. Thus, in their mortality-specification (Table 3, Proportion of Cumulative Deaths Over the Population), the estimate of all school closures (.204) and mandatory self-quarantine of travelers (0.363) is deemed insignificant based on schools CI [.029, .379] and quarantine CI [.193, .532]. We believe, these results should be interpreted as a significant increase in mortality, and that these results should have been part of their conclusion.

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1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
			closure) did not show any impact (Table 3, "Proportion of Cumulative Deaths Over the Population).	
Hale et al. (2020); "Global assessment of the relationship between government response measures and COVID-19 deaths"	COVID-19 mortality	Uses the OxCGRT stringency and COVID-19-deaths from the European Centre for Disease Prevention and Control for 170 countries. Estimates both cross-sectional models in which countries are the unit of analysis, as well as longitudinal models on time-series panel data with country-day as the unit of analysis (including models that use both time and country fixed effects).	Finds that higher stringency in the past leads to a lower growth rate in the present, with each additional point of stringency corresponding to a 0.039%-point reduction in daily deaths growth rates six weeks later.	
Hunter et al. (2021); "Impact of non-pharmaceutical interventions against COVID-19 in Europe: A quasi-experimental non-equivalent group and time-series"	COVID-19 mortality	Uses death data from the European Centre for Disease Prevention and Control (ECDC) and NPI-data from the Institute of Health Metrics and Evaluation. Argues that they use a quasi-experimental approach to identify the effect of NPIs because no analyzed intervention was imposed by all European countries and interventions were put in place at different points in the development of the epidemics.	Finds that mass gathering restrictions and initial business closures (businesses such as entertainment venues, bars and restaurants) reduces the number of deaths, whereas closing educational facilities and issuing SIPO increases the number of deaths. Finds no effect of closing non-essential services and mandating/recommending masks (Table 3)	Finds an effect of closing educational facilities and non-essential services after 1-7 days before lockdown could possibly have an effect on the number of deaths. This may indicate that other factors are driving their results.
Langeland et al. (2021); "The Effect of State Level COVID-19 Stay-at-Home Orders on Death Rates"	COVID-19 mortality	Estimates the effect of state-level lockdowns on COVID-19 deaths using multiple quasi-Poisson regressions with lockdown time length as the explanatory variable. Does not specify how lockdown is defined and what their data sources are.	Finds no significant effect of SIPO on the number of deaths after 2-4, 4-6 and 6+ weeks.	They write that "6+ weeks of lockdown is the only setting where the odds of dying are statistically higher than in the no lockdown case." However, all estimates are insignificant in Table C. Looks as if lockdown duration may cause a causality problem, because politicians may be less likely to ease restrictions when there are many cases/deaths.
Leffler et al. (2020); "Association of country-wide coronavirus mortality with demographics, testing, lockdowns, and public wearing of masks"	COVID-19 mortality	Use COVID-19 deaths from Worldometer and info about NPIs (mask/mask recommendations, international travel restrictions and lockdowns (defined as any closure of schools or workplaces, limits on public gatherings or internal movement, or stay-at-home orders) from Hale et al. (2020) for 200 countries to estimate the effect of the duration of NPIs on the number of deaths.	Finds that masking (mask recommendations) reduces mortality. For each week that masks were recommended the increase in per-capita mortality was 8.1% (compared to 55.7% increase when masks were not recommended). Finds no significant effect of the number of weeks with internal lockdowns and international travel restrictions (Table 2).	Their "mask recommendation" category includes some countries, where masks were mandated (see Supplemental Table A1) and may (partially) capture the effect of mask mandates. Looks at duration which may cause a causality problem, because politicians may be less likely to ease restrictions when there are many cases/deaths.
Mccafferty and Ashley (2021); "Covid-19 Social Distancing Interventions by Statutory Mandate and Their Observational	Other	Use data from 27 U.S. states and 12 European countries to analyze the effect of NPIs on peak morality rate using general linear mixed effects modelling.	Finds that no mandate (school closures, prohibition on mass gatherings, business closures, stay at home	

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1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
Correlation to Mortality in the United States and Europe"			orders, severe travel restrictions, and closure of non-essential businesses) was effective in reducing the peak COVID-19 mortality rate.	
Pan et al. (2020); "Covid-19: Effectiveness of non-pharmaceutical interventions in the united states before phased removal of social distancing protections varies by region"	COVID-19 mortality	Uses county-level data for all U.S. states. Mortality is obtained from Johns Hopkins, while policy data are obtained from official governmental websites. Categorizes 12 policies into 4 levels of disease control; Level 1 (low) - State of Emergency; Level 2 (moderate) - school closures, restricting access (visits) to nursing homes, or closing restaurants and bars; Level 3 (high) - non-essential business closures, suspending non-violent arrests, suspending elective medical procedures, suspending evictions, or restricting mass gatherings of at least 10 people; and Level 4 (aggressive) - sheltering in place / stay-at-home, public mask requirements, or travel restrictions. Use stepped-wedge cluster randomized trial (SW-CRT) for clustering and negative binomial mixed model regression.	Concludes that only (duration of, see comment in next column) level 4 restrictions are associated with reduced risk of death, with an average 15% decline in the COVID-19 death rate per day. Implementation of level 3 and level 2 restrictions increased death rates in 6 of 6 regions, while longer duration increased death rates in 5 of 6 regions.	They focus on the negative estimate of duration of Level 4. However, their implementation estimate is large and positive, and the combined effect of implementation and duration is unclear.
Pincombe et al. (2021); "The effectiveness of national-level containment and closure policies across income levels during the COVID-19 pandemic: an analysis of 113 countries"	COVID-19 mortality	Uses daily data for 113 countries on cumulative COVID-19 death counts over 130 days between February 15, 2020, and June 23, 2020, to examine changes in mortality growth rates across the World Bank's income group classifications following shelter-in-place recommendations or orders (they use one variable covering both recommendations and orders).	Finds that shelter-in-place recommendations/orders reduces mortality growth rates in high income countries (although insignificant) but increases growth rates in countries in other income groups.	
Sears et al. (2020); "Are we #stayinghome to Flatten the Curve?"	COVID-19 mortality	Uses cellular location data from all 50 states and the District of Columbia to investigate mobility patterns during the pandemic across states and time. Adding COVID-19 death tolls and the timing of SIPO for each state they estimate the effect of stay-at-home policies on COVID-19 mortality.	Find that SIPOs lower deaths by 0.13- 0.17 per 100,000 residents, equivalent to death rates 29-35% lower than in the absence of policies. However, these estimates are insignificant at a 95% confidence interval (see Table 4). The study also finds reductions in activity levels prior to mandates. Human encounter rate fell by 63 percentage points and nonessential visits by 39 percentage points relative to pre-COVID-19 levels, prior to any state implementing a statewide mandate	In the abstract the authors state that death rates would be 42-54% lower than in the absence of policies. However, this includes averted deaths due to pre-mandate social distancing behavior (p. 6). The effect of SIPO is a reduction in deaths by 29%-35% compared to a situation without SIPO but with pre-mandate social distancing. These estimates are insignificant at a 95% confidence interval.

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1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
Shiva and Molana (2021); "The Luxury of Lockdown"	COVID-19 mortality	Uses COVID-19-deaths and OxCGRT stringency from 169 countries to estimate the effect of lockdown on the number of deaths 1-8 weeks later. Finds that stricter lockdowns reduce COVID-19-deaths 4 weeks later (but insignificant 8 weeks later) and have the greatest effect in high income countries. Finds no effect of workplace closures in low-income countries.	A stricter lockdown (1 stringency point) reduces deaths by 0,1% after 4 weeks. After 8 weeks the effect is insignificant.	
Spiegel and Tookes (2021); "Business restrictions and Covid-19 fatalities"	COVID-19 mortality	Use data for every county in the United States from March through December 2020 to estimate the effect of various NPIs on the COVID-19-deaths growth rate. Derives causality by 1) assuming that state regulators primarily focus on the state's most populous counties, so state regulation in smaller counties can be viewed as a quasi randomized experiment, and 2) conducting county pair analysis, where similar counties in different states (and subject to different state policies) are compared.	Finds that some interventions (e.g. mask mandates, restaurant and bar closures, gym closures, and high-risk business closures) reduces mortality growth, while other interventions (closures of low- to medium-risk businesses and personal care/spa services) did not have an effect and may even have increased the number of deaths.	In total they analyze the lockdown effect of 21 variables. 14 of 21 estimates are significant, and of these 6 are negative (reduces deaths) while 8 are positive (increases deaths). Some results are far from intuitive. E.g. mask recommendations increases deaths by 48% while mask mandates reduces deaths by 12%, and closing restaurants and bars reduces deaths by 50%, while closing bars but not restaurants only reduces deaths by 5%.
Stockenhuber (2020); "Did We Respond Quickly Enough? How Policy-Implementation Speed in Response to COVID-19 Affects the Number of Fatal Cases in Europe"	COVID-19 mortality	Uses data for the number of COVID-19 infections and deaths and policy information for 24 countries from OxCGRT to estimate the effect of stricter lockdowns on the number of deaths using principal component analysis and a generalized linear mixed model.	Finds no significant effect of stricter lockdowns on the number of fatalities (Table 4).	Groups data on lockdown strictness into four groups and lose significant information and variation.
Stokes et al. (2020); "The relative effects of non-pharmaceutical interventions on early Covid-19 mortality: natural experiment in 130 countries"	COVID-19 mortality	Uses daily Covid-19 deaths for 130 countries from the European Centre for Disease Prevention and Control (ECDC) and daily policy data from the Oxford COVID-19 Government Response Tracker (OxCGRT). Looks at all levels of restrictions for each of the nine sub-categories of the OxCGRT stringency index (school, work, events, gatherings, transport, SIPO, internal movement, travel).	Of the nine sub-categories in the OxCGRT stringency index, only travel restrictions are consistently significant (with level 2 "Quarantine arrivals from high-risk regions" having the largest effect, and the strictest level 4 "Total border closure" having the smallest effect). Restrictions on very large gatherings (>1,000) has a large significant negative (fewer deaths) effect, while the effect of stricter restrictions on gatherings are insignificant. Authors recommend that the closing of schools (level 1) has a very large (in absolute terms it's twice the effect of border quarantines) positive	Their results are counter intuitive and somewhat inconclusive. Why does limiting very large gatherings (>1,000) work, while stricter limits do not? Why do recommending school closures cause more deaths? Why is the effect of border closures before 1st death insignificant, while the effect of closing borders after 1st death is significant (and large)? And why does quarantining arrivals from high-risk regions work better than total border closures? With 23 estimated parameters in total these counter intuitive and inconclusive results could be caused by multiple test bias (we correct for this in the meta-analysis), but may also be caused by other factors such as omitted variable bias.

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1. Study (Author & title)	2. Measure	3. Description	4. Results	5. Comments
			effect (more deaths) while stricter interventions on schools have no significant effect. Required cancelling of public events also has a significant positive (more deaths) effect. We focus on their 14-38 days results, as they catch the longest time frame (their 0-24 day model returns mostly insignificant results).	
Toya and Skidmore (2020); "A Cross-Country Analysis of the Determinants of Covid-19 Fatalities"	COVID-19 mortality	Uses COVID-19-deaths and lockdown info from various sources from 159 countries in a cross-country event study. Controls for country specifics by including socio-economic, political, geographic, and policy information. Finds little evidence for the efficacy of NPIs.	Complete travel restrictions prior to April 2020 reduced deaths by -0.226 per 100.000 by April 1st 2021, while mandatory national lockdown prior to April 2020 increased deaths by 0.166 by April 1st 2021. Recommended local lockdowns reduced deaths but results are based on one observation. Partial travel restrictions, mandatory local lockdowns and recommended national lockdowns did not have a significant effect on deaths.	The study looks at the lockdown status prior to April 2020 and the effect on deaths the following year (until April 1st 2021). The authors state this is to reduce concerns about endogeneity but do not explain why the lockdowns in the spring of 2020 are a good instrument for lockdowns during later waves are.
Tsai et al. (2021); "Coronavirus Disease 2019 (COVID-19) Transmission in the United States Before Versus After Relaxation of Statewide Social Distancing Measures"	Reproduction rate, Rt	Uses data for NPIs that were implemented and/or relaxed in U.S. states between 10 March and 15 July 2020. Using segmented linear regression, they estimate the extent to which relaxation of social distancing affected epidemic control, as indicated by the time-varying, state-specific effective reproduction number (Rt). Rt is based on death tolls.	Finds that in the 8 weeks prior to relaxing NPIs, Rt was declining, while after relaxation Rt started to increase.	Their Figure 1 shows that Rt on average increases app. 10 days before relaxation, which could indicate that other factors (omitted variables) affect the results.

Note: All comments on the significance of estimates are based on a 5% significance level unless otherwise stated.

It is difficult to make a conclusion based on the overview in Table 1. Is -0.073 to -0.326 deaths/million per stringency point, as estimated by Ashraf (2020), a large or a small effect relative to. the 98% reduction in mortality predicted by the study published by the Imperial College London (Ferguson et al. (2020). This is the subject for our meta-analysis in the next section. Here, it turns out that -0.073 to -0.326 deaths/million per stringency point is a relatively modest effect and only corresponds to a 2.4% reduction in COVID-19 mortality on average in the U.S. and Europe.

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4 Meta-analysis: The impact of lockdowns on COVID-19 mortality

We now turn to the meta-analysis, where we focus on the impact of lockdowns on COVID-19 mortality.

In the meta-analysis, we include 24 studies in which we can derive the relative effect of lockdowns on COVID-19 mortality, where mortality is measured as COVID-19-related deaths per million. In practice, this means that the studies we included estimate the effect of lockdowns on mortality or the effect of lockdowns on mortality growth rates, while using a counterfactual estimate.[26]

Our focus is on the effect of compulsory non-pharmaceutical interventions (NPI), policies that restrict internal movement, close schools and businesses, and ban international travel, among others. We do not look at the effect of voluntary behavioral changes (e.g. voluntary mask wearing), the effect of recommendations (e.g. recommended mask wearing), or governmental services (voluntary mass testing and public information campaigns), but only on mandated NPIs.

The studies we examine are placed in three categories. Seven studies analyze the effect of stricter lockdowns based on the OxCGRT stringency indices, 13 studies analyze the effect of SIPOs (6 studies only analyze SIPOs, while seven analyze SIPOs among other interventions), and 11 studies analyze the effect of specific NPIs independently (lockdown vs. no lockdown).[27] Each of these categories is handled so that comparable estimates can be made across categories. Below, we present the results for each category and show the overall results, as well as those based on various quality dimensions.

Quality dimensions
We include quality dimensions because there are reasons to believe that can affect a study's conclusion. Below we describe the dimensions, as well as our reasons to believe that they are necessary to fully understand the empirical evidence.

- *Peer-reviewed vs. working papers*: We distinguish between peer-reviewed studies and working papers as we consider peer-reviewed studies generally being of higher quality than working papers.[28]

- *Long vs. short time period*: We distinguish between studies based on long time periods (with data series ending *after* May 31, 2020) and short time periods (data series ending at or before May 31, 2020), because the first wave did not fully end before late June in the U.S. and Europe. Thus, studies relying on short data periods lack the last part of the first wave and may yield biased results if lockdowns only "flatten the curve" and do not prevent deaths.

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[26] As a minimum requirement, one needs to know the effect on the top of the curve.
[27] The total is larger than 21 because the 11 SIPO studies include seven studies which look at multiple measures.
[28] Vetted papers from CEPR Covid Economics are considered as working papers in this regard.

- *No early effect on mortality*: On average, it takes approximately three weeks from infection to death.[29] However, several studies find effects of lockdown on mortality almost immediately. Fowler et al. (2021) find a significant effect of SIPOs on mortality after just four days and the largest effect after 10 days. An early effect may indicate that other factors (omitted variables) drive the results, and, thus, we distinguish between studies which find an effect on mortality sooner than 14 days after lockdown and those that do not.[30] Note that many studies do not look at the short term and thus fall into the latter category by default.

- *Social sciences vs. other sciences*: While it is true that epidemiologists and researchers in natural sciences should, in principle, know much more about COVID-19 and how it spreads than social scientists, social scientists are, in principle, experts in evaluating the effect of various policy interventions. Thus, we distinguish between studies published by scholars in social sciences and by scholars from other fields of research. We perceive the former as being better suited for examining the effects of lockdowns on mortality. For each study, we have registered the research field for the corresponding author's associated institute (e.g., for a scholar from "Institute of economics" research field is registered as "Economics"). Where no corresponding author was available, the first author has been used. Afterwards, all research fields have been classified as either from the "Social Science" or "Other.""[31]

We also considered including a quality dimension to distinguish between studies based on excess mortality and studies based on COVID-19 mortality, as we believe that excess mortality is potentially a better measure for two reasons. First, data on total deaths in a country is far more precise than data on COVID-19 related deaths, which may be both underreported (due to lack of tests) or overreported (because some people die *with* – but not *because of* – COVID-19). Secondly, a major purpose of lockdowns is to save lives. To the extend lockdowns shift deaths *from* COVID-19 *to* other causes (e.g. suicide), estimates based on COVID-19 mortality will overestimate the effect of lockdowns. Likewise, if lockdowns save lives in other ways (e.g. fewer traffic accidents) lockdowns' effect on mortality will be underestimated. However, as only one

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[29] Leffler et al. (2020) writes, "On average, the time from infection with the coronavirus to onset of symptoms is 5.1 days, and the time from symptom onset to death is on average 17.8 days. Therefore, the time from infection to death is expected to be 23 days." Meanwhile, Stokes et al. (2020) writes that "evidence suggests a mean lag between virus transmission and symptom onset of 6 days, and a further mean lag of 18 days between onset of symptoms and death."

[30] Some of the authors are aware of this problem. E.g. Bjørnskov (2021a) writes "when the lag length extends to three or fourth weeks, that is, the length that is reasonable from the perspective of the virology of Sars-CoV-2, the estimates become very small and insignificant" and "these results confirm the overall pattern by being negative and significant when lagged one or two weeks (the period when they cannot have worked) but turning positive and insignificant when lagged four weeks."

[31] Research fields classified as social sciences were economics, public health, management, political science, government, international development, and public policy, while research fields not classified as social sciences were ophthalmology, environment, medicine, evolutionary biology and environment, human toxicology, epidemiology, and anesthesiology.

of the 34 studies (Bjørnskov (2021a)) is based on excess mortality, we are unfortunately forced to disregard this quality dimension.

Meta-data used for our quality dimensions as well as other relevant information are shown in Table 2.

Table 2: Metadata for the studies included in the meta-analysis

1. Study (Author & title)	2. Included in meta-analysis	3. Publication status	4. End of data period	5. Earliest effect	6. Field of research	7. Lockdown measure	8. Geographical coverage
Alderman and Harjoto (2020); "COVID-19: U.S. shelter-in-place orders and demographic characteristics linked to cases, mortality, and recovery rates"	Yes	Peer-review	11-Jun-20	n/a	Economics (Social science)	SIPO	United States
Aparicio and Grossbard (2021); "Are Covid Fatalities in the U.S. Higher than in the EU, and If so, Why?"	Yes	Peer-review	22-Jul-20	n/a	Economics (Social science)	Specific NPIs	Europe and United States
Ashraf (2020); "Socioeconomic conditions, government interventions and health outcomes during COVID-19"	Yes	WP	20-May-20	n/a	Economics (Social science)	Stringency	World
Auger et al. (2020); "Association between statewide school closure and COVID-19 incidence and mortality in the U.S."	Yes	Peer-review	07-May-20	>21 days	Medicine (Other)	Specific NPIs	United States
Berry et al. (2021); "Evaluating the effects of shelter-in-place policies during the COVID-19 pandemic"	Yes	Peer-review	30-May-20	8-14 days	Public policy (Social science)	SIPO	United States
Bjørnskov (2021a); "Did Lockdown Work? An Economist's Cross-Country Comparison"	Yes	Peer-review	30-Jun-20	<8 days	Economics (Social science)	Stringency	Europe
Blanco et al. (2020); "Do Coronavirus Containment Measures Work? Worldwide Evidence"	No	WP	31-Aug-20	8-14 days	Economics (Social science)	Specific NPIs	World
Bonardi et al. (2020); "Fast and local: How did lockdown policies affect the spread and severity of the covid-19"	Yes	WP	13-Apr-20	<8 days	Economics (Social science)	Specific NPIs	World
Bongaerts et al. (2021); "Closed for business: The mortality impact of business closures during the Covid-19 pandemic"	Yes	Peer-review	13-Apr-20	8-14 days	Management (Social science)	Specific NPIs	One country
Chaudhry et al. (2020); "A country level analysis measuring the impact of government actions, country preparedness and socioeconomic factors on COVID-19 mortality and related health outcomes"	Yes	Peer-review	01-Apr-20	n/a	Anesthesiology (Other)	Specific NPIs	World
Chernozhukov et al. (2021); "Causal impact of masks, policies, behavior on early covid-19 pandemic in the U.S."	Yes	Peer-review	03-Aun-20	n/a	Economics (Social science)	Specific NPIs	United States
Chisadza et al. (2021); "Government Effectiveness and the COVID-19 Pandemic"	Yes	Peer-review	01-Sep-20	n/a	Economics (Social science)	Stringency	World
Dave et al. (2021); "When Do Shelter-in-Place Orders Fight Covid-19 Best? Policy Heterogeneity Across States and Adoption Time"	Yes	Peer-review	20-Apr-20	Finds no effect	Economics (Social science)	SIPO	United States
Dergiades et al. (2020); "Effectiveness of government policies in response to the COVID-19 outbreak"	No	WP	30-Apr-20	n/a	Management (Social science)	Stringency	World
Fakir and Bharati (2021); "Pandemic catch-22: The role of mobility restrictions and institutional inequalities in halting the spread of COVID-19"	No	Peer-review	30-Jul-20	<8 days	Economics (Social science)	Stringency	World

1. Study (Author & title)	2. Included in meta-analysis	3. Publication status	4. End of data period	5. Earliest effect	6. Field of research	7. Lockdown measure	8. Geographical coverage
Fowler et al. (2021); "Stay-at-home orders associate with subsequent decreases in COVID-19 cases and fatalities in the United States"	Yes	Peer-review	07-May-20	<8 days	Public Health (Social science)	SIPO	United States
Fuller et al. (2021); "Mitigation Policies and COVID-19–Associated Mortality — 37 European Countries, January 23–June 30, 2020"	Yes	WP	30-Jun-20	n/a	Epidemiology (Other)	Stringency	Europe
Gibson (2020); "Government mandated lockdowns do not reduce Covid-19 deaths: implications for evaluating the stringent New Zealand response"	Yes	Peer-review	01-Jun-20	Finds no effect	Economics (Social science)	SIPO	United States
Goldstein et al. (2021); "Lockdown Fatigue: The Diminishing Effects of Quarantines on the Spread of COVID-19 "	Yes	WP	31-Dec-20	<8 days	International Development (Social science)	Stringency	World
Guo et al. (2021); "Mitigation Interventions in the United States: An Exploratory Investigation of Determinants and Impacts"	Yes	Peer-review	07-Apr-20	n/a	Social work (Social science)	Specific NPIs	United States
Hale et al. (2020); "Global assessment of the relationship between government response measures and COVID-19 deaths"	No	WP	27-May-20	n/a	Government (Social science)	Stringency	World
Hunter et al. (2021); "Impact of non-pharmaceutical interventions against COVID-19 in Europe: A quasi-experimental non-equivalent group and time-series"	No	Peer-review	24-Apr-20	<8 days	Medicine (Other)	Specific NPIs	Europe
Langeland et al. (2021); "The Effect of State Level COVID-19 Stay-at-Home Orders on Death Rates"	No	WP	Not specified	Finds no effect	Political Science (Social science)	Other	United States
Leffler et al. (2020); "Association of country-wide coronavirus mortality with demographics, testing, lockdowns, and public wearing of masks"	Yes	Peer-review	09-May-20	n/a	Ophthalmology (Other)	Specific NPIs	World
Mccafferty and Ashley (2021); "Covid-19 Social Distancing Interventions by Statutory Mandate and Their Observational Correlation to Mortality in the United States and Europe"	No	Peer-review	12-Apr-20	Finds no effect	Ophthalmology (Other)	Specific NPIs	Europe and United States
Pan et al. (2020); "Covid-19: Effectiveness of non-pharmaceutical interventions in the united states before phased removal of social distancing protections varies by region"	No	WP	29-May-20	n/a	Environment (Other)	Specific NPIs	United States
Pincombe et al. (2021); "The effectiveness of national-level containment and closure policies across income levels during the COVID-19 pandemic: an analysis of 113 countries"	No	Peer-review	23-Jun-20	n/a	Health Science (Social science)	SIPO	World
Sears et al. (2020); "Are we #stayinghome to Flatten the Curve?"	Yes	WP	29-Apr-20	Finds no effect	Economics (Social science)	SIPO	United States
Shiva and Molana (2021); "The Luxury of Lockdown"	Yes	Peer-review	08-Jun-20	15-21 days	Government (Social science)	Stringency	World
Spiegel and Tookes (2021); "Business restrictions and Covid-19 fatalities"	Yes	Peer-review	31-Dec-20	<8 days	Management (Social science)	Specific NPIs	United States
Stockenhuber (2020); "Did We Respond Quickly Enough? How Policy-Implementation Speed in Response to COVID-19 Affects the Number of Fatal Cases in Europe"	Yes	Peer-review	12-Jul-20	n/a	Evolutionary Biology and Environment (Other)	Stringency	Europe
Stokes et al. (2020); "The relative effects of non-pharmaceutical interventions on early	Yes	WP	01-Jun-20	n/a	Economics (Social science)	Specific NPIs	World

1. Study (Author & title)	2. Included in meta-analysis	3. Publication status	4. End of data period	5. Earliest effect	6. Field of research	7. Lockdown measure	8. Geographical coverage
Covid-19 mortality: natural experiment in 130 countries"							
Toya and Skidmore (2020); "A Cross-Country Analysis of the Determinants of Covid-19 Fatalities"	Yes	WP	01-Apr-21	n/a	Economics (Social science)	Specific NPIs	World
Tsai et al. (2021); "Coronavirus Disease 2019 (COVID-19) Transmission in the United States Before Versus After Relaxation of Statewide Social Distancing Measures"	No	Peer-review	15-Jul-20	<8 days	Psychiatry (Social science)	Specific NPIs	United States

Note: Research fields classified as social sciences were economics, public health, health science, management, political science, government, international development, and public policy, while research fields not classified as social sciences were ophthalmology, environment, medicine, evolutionary biology and environment, human toxicology, epidemiology and anesthesiology.

Interpreting and weighting estimates

The estimates used in the meta-analysis are not always readily available in the studies shown in Table 2. In Appendix B Table 9, we describe for each paper how we interpret the estimates and how they are converted to a common estimate (the relative effect of lockdowns on COVID-19 mortality) which is comparable across all studies.

Following Paldam (2015) and Stanley and Doucouliagos (2010), we also convert standard errors[32] and use the precision of each estimate (defined as 1/SE) to calculate the precision-weighted average of all estimates and present funnel plots. The precision-weighted average is our primary indicator of the efficacy of lockdowns, but we also report arithmetic averages and medians in the meta-analysis.

In the following sections, we present the meta-analysis for each of the three groups of studies (stringency index-studies, SIPO-studies, and studies analyzing specific NPIs).

4.1 Stringency index studies

Seven eligible studies examine the link between lockdown stringency and COVID-19 mortality. The results from these studies, converted to common estimates, are presented in Table 3 below. All studies are based on the COVID-19 Government Response Tracker's (OxCGRT) stringency index of Oxford University's Blavatnik School of Government (Hale et al. (2020)).

The OxCGRT stringency index neither measures the expected effectiveness of the lockdowns nor the expected costs. Instead, it describes the stringency based on nine equally weighted parameters.[33] Many countries followed similar patterns and almost all countries closed schools,

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[32] Standard errors are converted such that the t-value, calculated based on common estimates and standard errors, is unchanged. When confidence intervals are reported rather than standard errors, we calculate standard errors using t-distribution with ∞ degrees of freedom (i.e. 1.96 for 95% confidence interval).

[33] The nine parameters are "C1 School closing," "C2 Workplace closing," "C3 Cancel public events," "C4 Restrictions on gatherings," "C5 Close public transport," "C6 Stay at home requirements," "C7 Restrictions on internal movement," "C8 International travel controls" and "H1 Public information campaigns." The latter, "H1

while only a few countries issued SIPOs without closing businesses. Hence, it is reasonable to perceive the stringency index as continuous, although not necessarily linear. The index includes recommendations (e.g. "workplace closing" is 1 if the government recommends closing (or work from home), cf. Hale et al. (2021)), but the effect of including recommendations in the index is primarily to shift the index parallelly upward and should not alter the results relative to our focus on mandated NPIs. It is important to note that the index is not perfect. As pointed out by Book (2020), it is certainly possibly to identify errors and omissions in the index. However, the index is objective and unbiased and as such, useful for cross-sectional analysis with several observations, even if not suitable for comparing the overall strictness of lockdowns in two countries.

Since the studies examined use different units of estimates, we have created common estimates for Europe and United States to make them comparable. The common estimates show the effect of the average lockdown in Europe and United States (with average stringencies of 76 and 74, respectively, between March 16th and April 15th, 2020, compared to a policy based solely on recommendations (stringency 44)). For example, Ashraf (2020) estimates that the effect of stricter lockdowns is -0.073 to -0.326 deaths/million per stringency point. We use the average of these two estimates (-0.200) in the meta-analysis (see Table 9 in Appendix B for a description for all studies). The average lockdown in Europe between March 16th and April 15th, 2020, was 32 points stricter than a policy solely based on recommendations (76 vs. 44). In United States, it was 30 points. Hence, the total effect of the lockdowns compared to the recommendation policy was -6.37 deaths/million in Europe (32 x -0.200) and -5.91 deaths/million in United States. With populations of 748 million and 333 million, respectively the total effect as estimated by Ashraf (2020) is 4,766 averted COVID-19 deaths in Europe and 1,969 averted COVID-19 deaths in United States. By the end of the study period in Ashraf (2020), which is May 20, 2020, 164,600 people in Europe and 97,081 people in the United States had died of COVID-19. Hence, the 4,766 averted COVID-19 deaths in Europe and the 1,969 averted COVID-19 deaths in the United States corresponds to 2.8% and 2.0% of all COVID-19 deaths, respectively, with an arithmetic average of 2.4%. Our common estimate is thus -2.4%, cf. Table 3. So, this means that Ashraf (2020) estimates that without lockdowns, COVID-19 deaths in Europe would have been 169,366 and COVID-19 deaths in the U.S. would have been 99,050. Our approach is not unproblematic. First of all, the level of stringency varies over time for all countries. We use the stringency between March 16th and April 15th, 2020 because this period covers the main part of the first wave which most of the studies analyze. Secondly, OxCGRT has changed the index over time and a 10-point difference today may not be exactly the same as a 10-point difference when the studies were finalized. However, we believe these problems are unlikely to significantly alter our results.

Public information campaigns," is not an intervention following our definition, as it is not a mandatory requirement. However, of 97 European countries and U.S. States in the OxCGRT database, only Andorra, Belarus, Bosnia and Herzegovina, Faeroe Islands, and Moldova – less than 1.6% of the population – did not get the maximum score by March 20, 2020, so the parameter simply shifts the index parallelly upward and should not have notable impact on the analyzes.

Table 3 demonstrates that the studies find that lockdowns, on average, have reduced COVID-19 mortality rates by 0.2% (precision-weighted). The results yield a median of -2.4% and an arithmetic average of -7.3%. Only one of the seven studies, Fuller et al. (2021), finds a significant *and* (relative to the effect predicted in studies like Ferguson et al. (2020)) substantial effect of lockdowns (-35%). The other six studies find much smaller effects. Hence, based on the stringency index studies, we find little to no evidence that mandated lockdowns in Europe and the United States had a noticeable effect on COVID-19 mortality rates. And, as will be discussed in the next paragraph, the fifth column of Table 3 displays the number of quality dimensions (out of 4) met by each study.

Table 3: Overview of common estimates from studies based on stringency indexes

Effect on COVID-19 mortality	Estimate (Estimated Averted Deaths / Total Deaths)	Standard error	Weight (1/SE)	Quality dimensions
Bjørnskov (2021)	-0.3%	0.8%	119	3
Shiva and Molana (2021)	-4.1%	0.4%	248	4
Stockenhuber (2020)*	0.0%	n/a	n/a	3
Chisadza et al. (2021)	0.1%	0.0%	7,390	4
Goldstein et al. (2021)	-9.0%	3.8%	26	2
Fuller et al. (2021)	-35.3%	9.1%	11	2
Ashraf (2020)	-2.4%	0.4%	256	2
Precision-weighted average (arithmetic average / median)	**-0.2% (-7.3%/-2.4%)**			

Note: The table shows the estimates for each study converted to a common estimate, i.e. the implied effect on COVID-19 mortality in Europe and United States. A negative number corresponds to fewer deaths, so -5% means 5% lover COVID-19 mortality. For studies which report estimates in deaths per million, the common estimate is calculated as: (COVID-19 mortality with "common area's" policy) / (COVID-19 mortality with recommendation policy) -1, where (COVID-19 mortality with recommendation policy) is calculated as ((COVID-19 mortality with "common area's" policy) - Estimate x Difference in stringency x population). Stringencies in Europe and United States are equal to the average stringency from March 16th to April 15th 2020 (76 and 74 respectively) and the stringency for the policy based solely on recommendations is 44 following Hale et al. (2020). For the conversion of other studies see Table 9 in appendix B.
* It is not possible to calculate a common estimate for Stockenhuber (2020). When calculating arithmetic average / median, the study is included as 0%, because estimates are insignificant and signs of estimates are mixed (higher strictness can cause both lower and higher COVID-19 mortality).

We now turn to the quality dimensions. Table 4 presents the results differentiated by the four quality dimensions. Two studies, Shiva and Molana (2021) and Chisadza et al. (2021), meet all quality dimensions. The precision-weighted average for these studies is 0.0%, meaning that lockdowns had no effect on COVID-19 mortality. Two studies live up to 3 of 4 quality dimensions (Bjørnskov (2021a) and Stockenhuber (2020)). The precision-weighted average for these studies is -0.3%, meaning that lockdowns reduced COVID-19 mortality by 0.3%. Three studies lack at least two quality dimensions.[34] These studies find that lockdowns reduce COVID-19 mortality by 4.2%. To sum up, we find that the studies that meet at least 3 of 4 quality measures find that lockdowns have little to no effect on COVID-19 mortality, while studies that

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[34] In fact, the working papers by P. Goldstein et al. (2021), Fuller et al. (2021) and Ashraf (2020) all lack exactly two quality parameters.

meet 2 of 4 quality measures find a small effect on COVID-19 mortality. These results are far from those estimated with the use of epidemiological models, such as the Imperial College London (Ferguson et al. (2020).

Table 4: Overview of common estimates split on quality dimensions for studies based on stringency indexes

Values show effect on COVID-19 mortality	Precision-weighted average*	Arithmetic average	Median
Peer-reviewed vs. working papers			
Peer-reviewed [4]	0.0%	-1.1%	-0.2%
Working paper [3]	-4.2%	-15.6%	-9.0%
Long vs. short time period			
Data series ends after 31 May 2020 [6]	-0.1%	-8.1%	-0.2%
Data series ends before 31 May 2020 [1]	-2.4%	-2.4%	-9.0%
No early effect on mortality			
Does not find an effect within the first 14 days (including n/a) [5]	-0.2%	-8.3%	-2.4%
Finds effect within the first 14 days [2]	-1.9%	-4.7%	-4.7%
Social sciences vs. other sciences			
Social sciences [5]	-0.1%	-3.1%	-2.4%
Other sciences [2]	-35.3%	-17.7%	-17.7%
4 of 4 quality dimensions [2]	**0.0%**	**-2.0%**	**-2.0%**
3 of 4 quality dimensions [2]	**-0.3%**	**-0.2%**	**-0.2%**
2 of 4 quality dimensions or fewer [3]	**-4.2%**	**-15.6%**	**-9.0%**

*Note: The table shows the common estimate as described in Table 3 for each quality dimension. The number of studies in each category is in square brackets. * The precision-weighted average does not include studies where no common standard error is available, cf. Table 3.*

Figure 5 shows a funnel plot for the studies in Table 3, except Stockenhuber (2020), where common estimate standard errors cannot be derived. Chisadza et al. (2021) has a far higher precision than the other studies (1/SE is 7,398 and the estimate is 0.1%)[35], and there are indications that the estimate from Fuller et al. (2021) (the bottom left) is an imprecise outlier.[36] Figure 5 The plot also shows that the studies with at least 3 of 4 quality dimensions are centered around zero and generally have higher precision than other studies.

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[35] Excluding Chisadza et al. (2021) from the precision-weighted average changes the average to -3.5%.

[36] Excluding Fuller et al. (2021) from the precision-weighted average only marginally changes the average because the precision is very low.

Figure 5: Funnel plot for estimates from studies based on stringency indexes
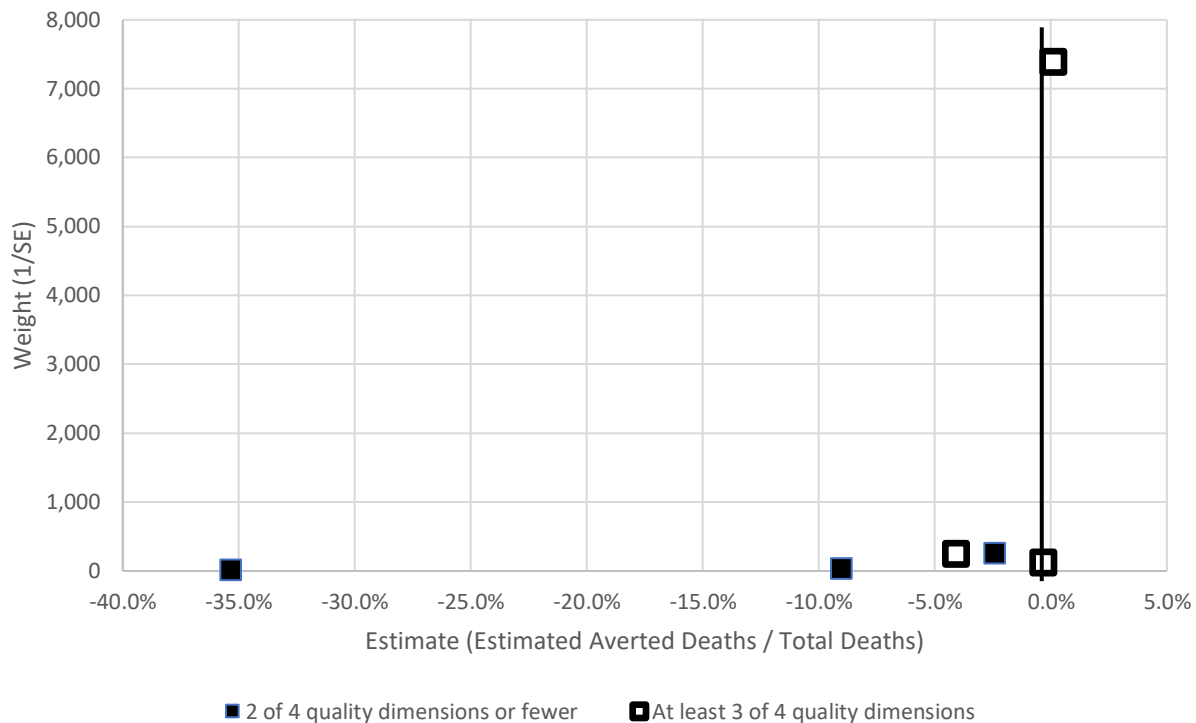
Note: The figure displays all estimates and the precision of the estimate defined as one over the standard error. Studies where standard errors are not available are not included. Studies which live up to at least 3 of 4 quality dimensions are marked with white, while studies which lives up to 2 of 3 quality dimensions or less are marked with black. The vertical line illustrates the precision-weighted average.

Overall conclusion on stringency index studies

Compared to a policy based solely on recommendations, we find little evidence that lockdowns had a noticeable impact on COVID-19 mortality Only one study, Fuller et al. (2021), finds a substantial effect, while the rest of the studies find little to no effect. Indeed, according to stringency index studies, lockdowns in Europe and the United States reduced only COVID-19 mortality by 0.2% on average.

In the following section we will look at the effect of SIPOs. The section follows the same structure as this section.

4.2 Shelter-in-place order (SIPO) studies

We have identified 13 eligible studies which estimate the effect of Shelter-In-Place Orders (SIPOs) on COVID-19 mortality, cf. Table 5. Seven of these studies look at multiple NPIs of which a SIPO is just one, while six studies estimate the effect of a SIPO vs. no SIPO in the United States. According to the containment and closure policy indicators from OxCGRT, 41 states in the U.S. issued SIPOs in the spring of 2020. But usually, these were introduced after implementing other NPIs such as school closures or workplace closures. On average, SIPOs

were issued 7½ days after *both* schools and workplaces closed, and 12 days after the first of the two closed. Only one state, Tennessee, issued a SIPO before schools and workplaces closed. The 10 states that did not issue SIPOs all closed schools. Moreover, of those 10 states, three closed some non-essential businesses, while the remaining 7 closed all non-essential businesses. Because of this, we perceive estimates for SIPOs based on U.S.-data as the marginal effect of SIPOs on top of other restrictions, although we acknowledge that the estimates may capture the effects of other NPI measures as well.

The results of eligible studies based on SIPOs are presented in Table 5. The table demonstrates that the studies generally find that SIPOs have reduced COVID-19 mortality by 2.9% (on a precision-weighted average). There is an apparent difference between studies in which a SIPO is one of multiple NPIs, and studies in which a SIPO is the only examined intervention. The former group generally finds that SIPOs *increase* COVID-19 mortality *marginally*, whereas the latter finds that SIPOs *decrease* COVID-19 mortality. As we will see below, this difference could be explained by differences in the quality dimensions, and especially the time period covered by each study.

Table 5: Overview of estimates from studies based on SIPOs

Values show effect on COVID-19 mortality	Estimate (Estimated Averted Deaths / Total Deaths)	Standard error	Weight (1/SE)	Quality dimensions
Studies where SIPO is one of several examined interventions and not (as) likely to capture the effect of other interventions				
Chernozhukov et al. (2021)	-17.7%	14.3%	7	4
Chaudhry et al. (2020) *	0.0%	n/a	n/a	2
Aparicio and Grossbard (2021)	2.6%	2.8%	35	4
Stokes et al. (2020)	0.8%	11.1%	9	3
Spiegel and Tookes (2021)	13.1%	6.6%	15	3
Bonardi et al. (2020)	0.0%	n/a	n/a	1
Guo et al. (2021)	4.6%	14.8%	4	3
Average (median) where SIPO is one of several variables	2.8% (0.5%/0.8%)			
Studies where SIPO is the only examined intervention and may capture the effect of other interventions				
Sears et al. (2020)	-32.2%	17.6%	6	2
Alderman and Harjoto (2020)	-1.0%	0.6%	169	4
Berry et al. (2020)	1.1%	n/a	n/a	2
Fowler et al. (2021)	-35.0%	7.0%	14	2
Gibson (2020)	-6.0%	24.3%	4	4
Dave et al. (2020)	-40.8%	36.1%	3	3
Average (median) where SIPO is the only variable	-5.1% (-19.0%/-19.1%)			
Precision-weighted average (arithmetic average / median) for all studies	**-2.9% (-8.5%/0.0%)**			

*Note: * Chaudhry et al. (2020) does not provide an estimate but states that SIPO is insignificant. We use 0% when calculating the arithmetic average and median. Chaudhry et al. (2020) and Berry et al. (2021) do not affect the precision-weighted average, as we do not know the standard errors.*

Table 6 presents the results differentiated by quality dimensions. Four studies (Chernozhukov et al. (2021), Aparicio and Grossbard (2021), Alderman and Harjoto (2020) and Gibson (2020))

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meet all quality dimensions but find vastly different effects of SIPOs on COVID-19 mortality. The precision weighted average of the four studies is -1.0%. Four studies meet 3 of 4 quality dimensions. They overall find that SIPOs *increase* COVID-19 mortality, as the precision-weighted average is positive (3.7%). The five studies that meet 2 of 4 quality dimensions or fewer[37] find a substantial reduction in COVID-19-mortality (-34.2%). This substantial reduction seems to be driven by relatively short data series. The latest data point for the three studies which find large effects of lockdowns (Sears et al. (2020), Fowler et al. (2021), and Dave et al. (2021)) are April 29, May 7, and April 20, respectively. This may indicate that SIPOs can delay deaths but not eliminate them completely. Disregarding these studies with short data series, the precision-weighted average is -0.1%.

Table 6: Quality dimensions for studies based on SIPOs

| *Values show effect on COVID-19 mortality*	Precision-weighted average[*]	Arithmetic average	Median
Peer-reviewed vs. working papers			
Peer-review [10]	-2.4%	-7.9%	-0.5%
Working paper [3]	-12.0%	-10.5%	0.0%
Long vs. short time period			
Data serie ends after 31 May 2020 [6]	-0.1%	-1.4%	-0.1%
Data serie ends before 31 May 2020 [7]	-25.9%	-14.6%	0.0%
No early effect on mortality			
Finds effect within the first 14 days [9]	-2.0%	-10.0%	-1.0%
Does not find an effect within the first 14 days (including n/a) [4]	-10.3%	-5.2%	0.0%
Social sciences vs. other sciences			
Social sciences [12]	-2.9%	-9.2%	-0.5%
Other sciences [1]	n/a	0.0%	0.0%
4 of 4 quality dimensions [4]	-1.0%	-5.5%	-3.5%
3 of 4 quality dimensions [4]	3.7%	-5.6%	2.7%
2 of 4 quality dimensions or fewer [5]	-34.2%	-13.2%	0.0%

Note: The table shows the common estimate as described in Table 5 for each quality dimension. The number of studies in each category is in square brackets. [*] The precision-weighted average does not include studies where no common standard error is available, cf. Table 5.

Figure 6 shows a funnel plot for the studies in Table 5, except Chaudhry et al. (2020) and Berry et al. (2021), where common standard errors cannot be derived. Sears et al. (2020) stands out with a precision far higher than those of the other studies. But generally, the precisions of the studies are low and the estimates are placed on both sides of the zero-line with some 'tail' to the

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[37] Bonardi et al. (2020) only meet one quality dimension (social science).

left.[38] Figure 5 also shows that four of eight studies with at least 3 of 4 quality dimensions find that SIPOs *increase* COVID-19 mortality by 0.8% to 13.1%.

Figure 6: Funnel plot for estimates from SIPO studies
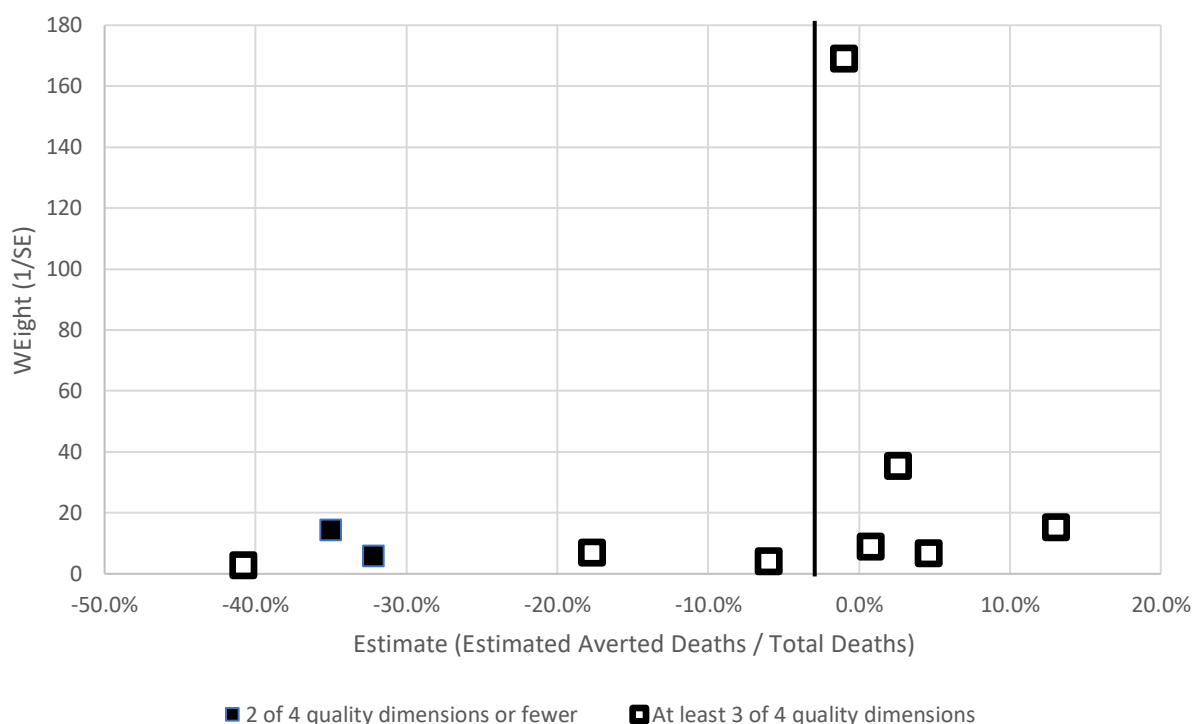
Note: The figure displays all estimates and the precision of the estimate defined as one over the standard error. Studies where standard errors are not available are not included. Studies which live up to at least 3 of 4 quality dimensions are marked with white, while studies which lives up to 2 of 4 quality dimensions or less are marked with black. The vertical line illustrates the precision-weighted average.

Overall conclusion on SIPO studies

We find no clear evidence that SIPOs had a noticeable impact on COVID-19 mortality. Some studies find a large negative relationship between lockdowns and COVID-19 mortality, but this seems to be caused by short data series which does not cover a full COVID-19 'wave'. Several studies find a small positive relationship between lockdowns and COVID-19 mortality. Although this appears to be counterintuitive, it could be the result of an (asymptomatic) infected person being isolated at home under a SIPO can infect family members with a higher viral load causing more severe illness.[39] The overall effect measured by the precision-weighted average is -2.9%. The result is in line with Nuzzo et al. (2019), who state that "In the context of a high-impact

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[38] This could indicate some publication bias, but the evidence is weak and with only 13 estimates, this cannot be formally tested

[39] E.g. see Guallar et al. (2020), who concludes, "Our data support that a greater viral inoculum at the time of SARS-CoV-2 exposure might determine a higher risk of severe COVID-19."

respiratory pathogen, quarantine may be the least likely NPI to be effective in controlling the spread due to high transmissibility" and World Health Organization Writing Group (2006), who conclude that "forced isolation and quarantine are ineffective and impractical."[40]

In the following section, we will look at the effect found in studies analyzing specific NPIs.

4.3 Studies of specific NPIs

A total of 11 eligible studies look at (multiple) specific NPIs independently or simply lockdown vs. no lockdown.[41] The definition of the specific NPIs varies from study to study and are somewhat difficult to compare. The variety in the definitions can be seen in the analysis of non-essential business closures and bar/restaurant closures. Chernozhukov et al. (2021) focus on a combined parameter (the average of business closure and bar/restaurant closure in each state), Aparicio and Grossbard (2021) look at business closure but not bar/restaurant closure, Spiegel and Tookes (2021) examine bar/restaurant closure but not business closure, and Guo et al. (2021) look at both business closures and bar/restaurant closures independently.

Some studies include several NPIs (e.g. Stokes et al. (2020) and Spiegel and Tookes (2021)), while others cover very few. Bongaerts et al. (2021) only study business closures, and Leffler et al. (2020) look at internal lockdown and international travel restrictions). Few NPIs in a model are potentially a problem because they can capture the effect of excluded NPIs. On the other hand, several NPIs in a model increase the risk of multiple test bias.

The differences in the choice of NPIs and in the number of NPIs make it challenging to create an overview of the results. In Table 7, we have merged the results in six overall categories but note that the estimates may not be fully comparable across studies. In particular, the lockdown-measure varies from study to study and in some cases is poorly defined by the authors. Also, there are only a few estimates within some of the categories. For instance, the estimate of the effect of facemasks is based on only two studies.

Table 7 illustrates that generally there is no evidence of a noticeable relationship between the most-used NPIs and COVID-19. Overall, lockdowns and limiting gatherings seem to increase COVID-19 mortality, although the effect is modest (0.6% and 1.6%, respectively) and border closures has little to no effect on COVID-19 mortality, with a precision-weighted average of -0.1% (removing the imprecise outlier from Guo et al. (2021) changes the precision-weighted average to -0.2%). We find a small effect of school closure (-4.4%), but this estimate is mainly driven by Auger et al. (2020), who – as noted earlier – use an "interrupted time series study"

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[40] Both Nuzzo et al. (2019) and World Health Organization Writing Group (2006) focus on quarantining infected persons. However, if quarantining infected persons is not effective, it should be no surprise that quarantining uninfected persons could be ineffective too.

[41] Note that we – according to our search strategy – did not search on specific measures such as "school closures" but on words describing the overall political approach to the COVID-19 pandemic such as "non-pharmaceutical," "NPIs," "lockdown" etc.

approach and may capture other effects such as seasonal and behavioral effects. The absence of a notable effect of school closures is in line with Irfan et al. (2021), who – based on a systematic review and meta-analysis of 90 published or preprint studies of transmission in children – concluded that "risks of infection among children in educational-settings was lower than in communities. Evidence from school-based studies demonstrate it is largely safe for young children (<10 years of age) to be at schools; however, older children (between 10 and 19 years of age) might facilitate transmission." UNICEF (2021) and ECDC (2020) reach similar conclusions.[42]

Mandating facemasks – an intervention that was not widely used in the spring of 2020, and in many countries was even discouraged – seems to have a large effect (-21.2%), but this conclusion is based on only two studies.[43] Again, our categorization may play a role, as the larger mask-estimate from Chernozhukov et al. (2021) is in fact "employee facemasks," not a general mask mandate. Our findings are somewhat in contrast to the result found in a review by Liu et al. (2021), who conclude that "fourteen of sixteen identified randomized controlled trials comparing face masks to no mask controls failed to find statistically significant benefit in the intent-to-treat populations." Similarly, a pre-COVID Cochrane review concludes, "There is low certainty evidence from nine trials (3507 participants) that wearing a mask may make little or no difference to the outcome of influenza-like illness (ILI) compared to not wearing a mask (risk ratio (RR) 0.99, 95% confidence interval (CI) 0.82 to 1.18). There is moderate certainty evidence that wearing a mask probably makes little or no difference to the outcome of laboratory-confirmed influenza compared to not wearing a mask (RR 0.91, 95% CI 0.66 to 1.26; 6 trials; 3005 participants)" (Jefferson et al. (2020)).[44] However, it should be noted that even if no effect is found in controlled settings, this does not necessarily imply that mandated face masks does not reduce mortality, as other factors may play a role (e.g. wearing a mask may function as a tax on socializing if people are bothered by wearing a face masks when they are socializing).

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[42] UNICEF (2021) concludes, "The preliminary findings thus far suggest that in-person schooling – especially when coupled with preventive and control measures – had lower secondary COVID-19 transmission rates compared to other settings and do not seem to have significantly contributed to the overall community transmission risks." Whereas, ECDC (2020) conclude, "School closures can contribute to a reduction in SARS-CoV-2 transmission, but by themselves are insufficient to prevent community transmission of COVID-19 in the absence of other nonpharmaceutical interventions (NPIs) such as restrictions on mass gathering," and states, "There is a general consensus that the decision to close schools to control the COVID-19 pandemic should be used as a last resort. The negative physical, mental health and educational impact of proactive school closures on children, as well as the economic impact on society more broadly, would likely outweigh the benefits."

[43] Note again, that we – according to our search strategy – did not search on the specific measures such as "masks," "face masks," "surgical masks" but on words describing the overall political approach to the COVID-19 pandemic such as "non-pharmaceutical," "NPIs," "lockdown" etc. Thus, we do not include most of the studies in mask reviews such as Liu et al. (2021) and Jefferson et al. (2020).

[44] Lipp and Edwards (2014) also find no evidence of an effect and – looking at disposable surgical face masks for preventing surgical wound infection in clean surgery – conclude, "Three trials were included, involving a total of 2113 participants. There was no statistically significant difference in infection rates between the masked and unmasked group in any of the trials." Meanwhile, Li et al. (2021) – based on six case-control studies – conclude, "In general, wearing a mask was associated with a significantly reduced risk of COVID-19 infection (OR = 0.38, 95% CI: 0.21-0.69, I^2 = 54.1%).

Only business closure consistently shows evidence of a negative relationship with COVID-19 mortality, but the variation in the estimated effect is large. Three studies find little to no effect, and three find large effects. Two of the larger effects are related to closing bars and restaurants. The "close business" category in Chernozhukov et al. (2021) is an average of closed businesses, restaurants, and movie theaters, while that same category is "closing restaurants and bars" in Spiegel and Tookes (2021). The last study finding a large effect is Bongaerts et al. (2021), the only eligible single-country study.[45]

As a final observation on Table 7, studies with fewer quality dimensions seem to find larger effects, but the pattern is not systematic.[46]

Table 7: Overview of estimates from studies of specific NPIs

	Lockdown (complete/ partial)	Facemasks/ Employee face masks	Business closure (/bars & restaurants)	Border closure (/quarantine)	School closures	Limiting gatherings	Quality dimensions
Chernozhukov et al. (2021)		-34.0%	-28.6%				4
Bongaerts et al. (2021)			-31.6%				2
Chaudhry et al. (2020)*	0.0%			0.0%			2
Toya & Skidmore (2021)	0.5%			-0.1%			3
Aparicio & Grossbard (2021)			-1.3%		0.5%	0.8%	4
Auger et al. (2020)					-58.0%		2
Leffler et al. (2020)	1.7%			-15.6%			2
Stokes et al. (2020)			0.3%	-24.6%	-0.1%	-6.3%	3
Spiegel & Tookes (2021)		-13.5%	-50.2%			11.8%	3
Bonardi et al. (2020)*	0.0%			0.0%			1
Guo et al. (2021)			-0.4%	36.3%	-0.2%	5.7%	3
Precision-weighted average	0.6%	-21.2%	-10.6%	-0.1%	-4.4%	1.6%	
Arithmetic average	0.6%	-23.8%	-18.6%	-0.7%	-14.4%	3.0%	
Median	0.3%	-23.8%	-14.9%	0.0%	-0.1%	3.2%	
4 of 4 quality dimensions	n/a [0]	-34.0% [1]	-2.9% [2]	n/a [0]	0.5% [1]	0.8% [1]	
3 of 4 quality dimensions	0.5% [1]	-13.5% [1]	-21.5% [3]	0.0% [3]	-0.1% [2]	5.6% [3]	
2 of 4 quality dimensions or fewer	1.7% [2]	n/a [1]	-31.6% [2]	-15.6% [2]	-58.0% [1]	n/a [1]	

*Note: * It is not possible to derive common estimates and standard errors from Chaudhry et al. (2020) and Bonardi et al. (2020). Chaudhry et al. (2020) states that the effect of the various NPIs is insignificant without listing the estimates and standard errors. Bonardi et al. (2020) states that partial or regional lockdowns are as effective as stricter NPIs but does not provide information to calculate common estimates. Instead, we assume the estimate is 0% when calculating arithmetic average and median, while the estimates are excluded from the calculation of precision-weighted averages because there are no standard errors.*

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[45] Bongaerts et al. (2021) (implicitly) assume that municipalities with different exposures to closed sectors are not inherently different, which may be a relatively strong assumption and could potentially drive their results.

[46] We saw with SIPOs that studies based on short data series tended to find larger effects than studies based on short data series. This is also somewhat true for studies examining multiple specific measures. If we focus on studies with long data series (>May 31st, 2020), the precision-weighted estimates are as follows (average for all studies in parentheses for easy comparison): Lockdown (complete/partial): 0.5% (0.6%), Facemasks/Employee face masks: -21.2% (-21.2%), Business closures (/bars & restaurants): -8.1% (-10.6%), Border closures (/quarantine): -0.1% (-0.1%), School closures: 0.5% (-4.4%), Limiting gatherings: 1.4% (1.6%).

Figure 7 shows a funnel plot for all estimates in Table 7, except Chaudhry et al. (2020) and Bonardi et al. (2020), where common standard errors cannot be derived. Two estimates from Toya and Skidmore (2020) stands out with a precision far higher than those of other studies, and estimates are placed with some 'tail' to the left, which could indicate some publication bias, i.e. reluctance to publish results that show large positive (more deaths) effects of lockdowns. The most precise estimates are gathered around 0%, while less precise studies are spread out between -58% and 36%. The precision-weighted average of all estimates across all NPIs is -0.6%.

Figure 7: Funnel plot for estimates from studies of specific NPIs
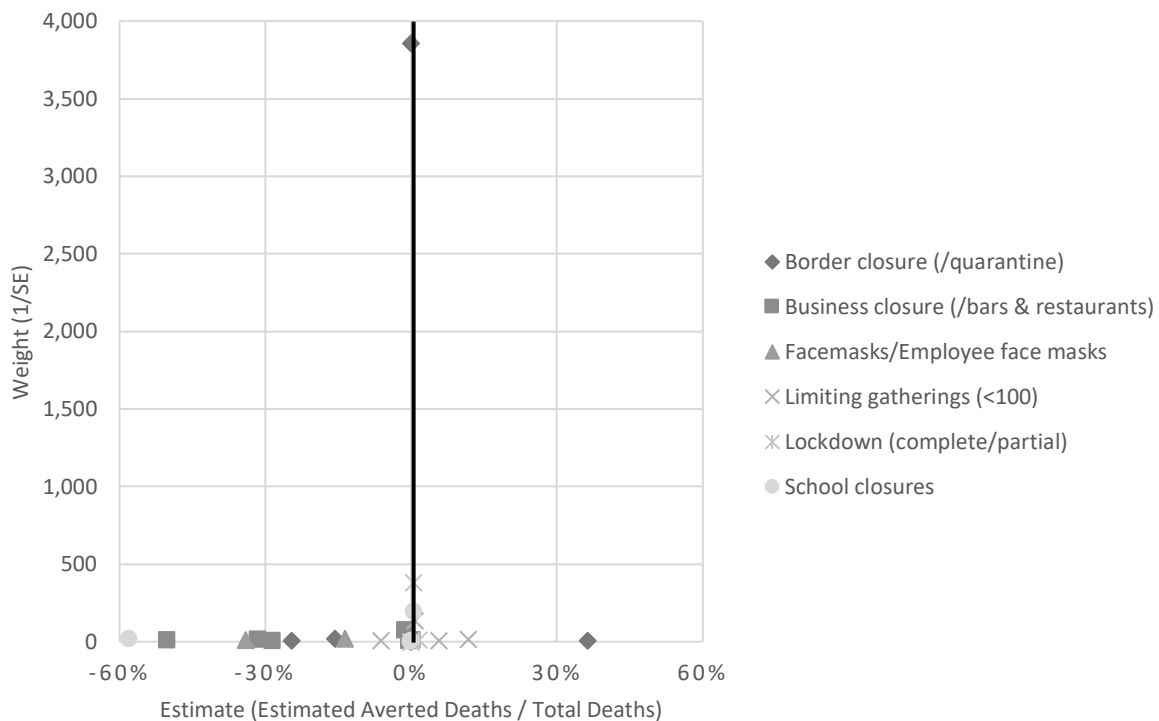
Note: The figure displays all estimates except two (se text in figure) of specific NPIs and the precision of the estimate defined as one over the standard error. Studies where standard errors are not available are not included.

Overall conclusion on specific NPIs

Because of the heterogeneity in NPIs across studies, it is difficult to draw strong conclusions based on the studies of multiple specific measures. We find no evidence that lockdowns, school closures, border closures, and limiting gatherings have had a noticeable effect on COVID-19 mortality. There is some evidence that business closures reduce COVID-19 mortality, but the variation in estimates is large and the effect seems related to closing bars. There may be an effect of mask mandates, but just two studies look at this, one of which one only looks at the effect of employee mask mandates.

5 Concluding observations

Public health experts and politicians have – based on forecasts in epidemiological studies such as that of Imperial College London (Ferguson et al. (2020) – embraced compulsory lockdowns as an effective method for arresting the pandemic. But, have these lockdown policies been effective in curbing COVID-19 mortality? This is the main question answered by our meta-analysis.

Adopting a systematic search and title-based screening, we identified 1,048 studies published by July 1st, 2020, which potentially look at the effect of lockdowns on mortality rates. To answer our question, we focused on studies that examine the actual impact of lockdowns on COVID-19 mortality rates based on registered cross-sectional mortality data and a counterfactual difference-in-difference approach. Out of the 1,048 studies, 34 met our eligibility criteria.

Conclusions
Overall, our meta-analysis fails to confirm that lockdowns have had a large, significant effect on mortality rates. Studies examining the relationship between lockdown strictness (based on the OxCGRT stringency index) find that the average lockdown in Europe and the United States only reduced COVID-19 mortality by 0.2% compared to a COVID-19 policy based solely on recommendations. Shelter-in-place orders (SIPOs) were also ineffective. They only reduced COVID-19 mortality by 2.9%.

Studies looking at specific NPIs (lockdown vs. no lockdown, facemasks, closing non-essential businesses, border closures, school closures, and limiting gatherings) also find no broad-based evidence of noticeable effects on COVID-19 mortality. However, closing non-essential businesses seems to have had some effect (reducing COVID-19 mortality by 10.6%), which is likely to be related to the closure of bars. Also, masks may reduce COVID-19 mortality, but there is only one study that examines universal mask mandates. The effect of border closures, school closures and limiting gatherings on COVID-19 mortality yields precision-weighted estimates of -0.1%, -4.4%, and 1.6%, respectively. Lockdowns (compared to no lockdowns) also do not reduce COVID-19 mortality.

Discussion
Overall, we conclude that lockdowns are not an effective way of reducing mortality rates during a pandemic, at least not during the first wave of the COVID-19 pandemic. Our results are in line with the World Health Organization Writing Group (2006), who state, "Reports from the 1918 influenza pandemic indicate that social-distancing measures did not stop or appear to dramatically reduce transmission […] In Edmonton, Canada, isolation and quarantine were instituted; public meetings were banned; schools, churches, colleges, theaters, and other public gathering places were closed; and business hours were restricted without obvious impact on the epidemic." Our findings are also in line with Allen's (2021) conclusion: "The most recent research has shown that lockdowns have had, at best, a marginal effect on the number of Covid-19 deaths." Poeschl and Larsen (2021) conclude that "interventions are generally effective in

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mitigating COVID-19 spread". But, 9 of the 43 (21%) results they review find "no or uncertain association" between lockdowns and the spread of COVID-19, suggesting that evidence from that own study contradicts their conclusion.

The findings contained in Johanna et al. (2020) are in contrast to our own. They conclude that "for lockdown, ten studies consistently showed that it successfully reduced the incidence, onward transmission, and mortality rate of COVID-19." The driver of the difference is three-fold. First, Johanna et al. include modelling studies (10 out of a total of 14 studies), which we have explicitly excluded. Second, they included interrupted time series studies (3 of 14 studies), which we also exclude. Third, the only study using a difference-in-difference approach (as we have done) is based on data collected before May 1st, 2020. We should mention that our results indicate that early studies find relatively larger effects compared to later studies.

Our main conclusion invites a discussion of some issues. Our review does not point out *why* lockdowns did not have the effect promised by the epidemiological models of Imperial College London (Ferguson et al. (2020)). We propose four factors that might explain the difference between our conclusion and the view embraced by some epidemiologists.

First, people respond to dangers outside their door. When a pandemic rages, people believe in social distancing regardless of what the government mandates. So, we believe that Allen (2021) is right, when he concludes, "The ineffectiveness [of lockdowns] stemmed from individual changes in behavior: either non-compliance or behavior that mimicked lockdowns." In economic terms, you can say that the demand for costly disease prevention efforts like social distancing and increased focus on hygiene is high when infection rates are high. Contrary, when infection rates are low, the demand is low and it may even be morally and economically rational not to comply with mandates like SIPOs, which are difficult to enforce. Herby (2021) reviews studies which distinguish between mandatory and voluntary behavioral changes. He finds that – on average – voluntary behavioral changes are 10 times as important as mandatory behavioral changes in combating COVID-19. If people voluntarily adjust their behavior to the risk of the pandemic, closing down non-essential businesses may simply reallocate consumer visits away from "nonessential" to "essential" businesses, as shown by Goolsbee and Syverson (2021), with limited impact on the total number of contacts.[47] This may also explain why epidemiological model simulations such as Ferguson et al. (2020) – which do not model behavior endogenously – fail to forecast the effect of lockdowns.

Second, mandates only regulate a fraction of our potential contagious contacts and can hardly regulate nor enforce handwashing, coughing etiquette, distancing in supermarkets, etc. Countries like Denmark, Finland, and Norway that realized success in keeping COVID-19 mortality rates relatively low allowed people to go to work, use public transport, and meet privately at home during the first lockdown. In these countries, there were ample opportunities to legally meet with others.

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[47] In economic terms, lockdowns are substitutes for – not complements to – voluntary behavioral changes.

Third, even if lockdowns are successful in initially reducing the spread of COVID-19, the behavioral response may counteract the effect completely, as people respond to the lower risk by changing behavior. As Atkeson (2021) points out, the economic intuition is straightforward. If closing bars and restaurants causes the prevalence of the disease to fall toward zero, the demand for costly disease prevention efforts like social distancing and increased focus on hygiene also falls towards zero, and the disease will return.[48]

Fourth, unintended consequences may play a larger role than recognized. We already pointed to the possible unintended consequence of SIPOs, which may isolate an infected person at home with his/her family where he/she risks infecting family members with a higher viral load, causing more severe illness. But often, lockdowns have limited peoples' access to safe (outdoor) places such as beaches, parks, and zoos, or included outdoor mask mandates or strict outdoor gathering restrictions, pushing people to meet at less safe (indoor) places. Indeed, we do find some evidence that limiting gatherings was counterproductive and increased COVID-19 mortality.

One objection to our conclusions may be that we do not look at the role of timing. If timing is very important, differences in timing may empirically overrule any differences in lockdowns. We note that this objection is not necessarily in contrast to our results. If timing is very important relative to strictness, this suggests that well-timed, but very mild, lockdowns should work as well as, or better than, less well-timed but strict lockdowns. This is not in contrast to our conclusion, as the studies we reviewed analyze the effect of lockdowns compared but to doing very little (see Section 3.1 for further discussion). However, there is little solid evidence supporting the timing thesis, because it is inherently difficult to analyze (see Section 2.2 for further discussion). Also, even if it can be empirically stated that a well-timed lockdown is effective in combating a pandemic, it is doubtful that this information will ever be useful from a policy perspective.

But, what explains the differences between countries, if not differences in lockdown policies? Differences in population age and health, quality of the health sector, and the like are obvious factors. But several studies point at less obvious factors, such as culture, communication, and coincidences. For example, Frey et al. (2020) show that for the same policy stringency, countries with more obedient and collectivist cultural traits experienced larger declines in geographic mobility relative to their more individualistic counterpart. Data from Germany Laliotis and Minos (2020) shows that the spread of COVID-19 and the resulting deaths in predominantly Catholic regions with stronger social and family ties were much higher compared to non-Catholic ones at the local NUTS 3 level.[49]

Government communication may also have played a large role. Compared to its Scandinavian neighbors, the communication from Swedish health authorities was far more subdued and embraced the idea of public health vs. economic trade-offs. This may explain why Helsingen et

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[48] This kind of behavior response may also explain why Subramanian and Kumar (2021) find that increases in COVID-19 cases are unrelated to levels of vaccination across 68 countries and 2947 counties in the United States. When people are vaccinated and protected against severe disease, they have less reason to be careful.

[49] The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU and the UK. There are 1215 regions at the NUTS 3-level.

al. (2020), found, based on questionnaire data collected from mid-March to mid-April, 2020, that even though the daily COVID-19 mortality rate was more than four times higher in Sweden than in Norway, Swedes were less likely than Norwegians to not meet with friends (55% vs. 87%), avoid public transportation (72% vs. 82%), and stay home during spare time (71% vs. 87%). That is, despite a more severe pandemic, Swedes were less affected in their daily activities (legal in both countries) than Norwegians.

Many other factors may be relevant, and we should not underestimate the importance of coincidences. An interesting example illustrating this point is found in Arnarson (2021) and Björk et al. (2021), who show that areas where the winter holiday was relatively late (in week 9 or 10 rather than week 6, 7 or 8) were hit especially hard by COVID-19 during the first wave because the virus outbreak in the Alps could spread to those areas with ski tourists. Arnarson (2021) shows that the effect persists in later waves. Had the winter holiday in Sweden been in week 7 or week 8 as in Denmark, the Swedish COVID-19 situation could have turned out very differently.[50]

Policy implications
In the early stages of a pandemic, before the arrival of vaccines and new treatments, a society can respond in two ways: mandated behavioral changes or voluntary behavioral changes. Our study fails to demonstrate significant positive effects of mandated behavioral changes (lockdowns). This should draw our focus to the role of voluntary behavioral changes. Here, more research is needed to determine how voluntary behavioral changes can be supported. But it should be clear that one important role for government authorities is to provide information so that citizens can voluntarily respond to the pandemic in a way that mitigates their exposure.

Finally, allow us to broaden our perspective after presenting our meta-analysis that focuses on the following question: "What does the evidence tell us about the effects of lockdowns on mortality?" We provide a firm answer to this question: The evidence fails to confirm that lockdowns have a significant effect in reducing COVID-19 mortality. The effect is little to none.

The use of lockdowns is a unique feature of the COVID-19 pandemic. Lockdowns have not been used to such a large extent during any of the pandemics of the past century. However, lockdowns during the initial phase of the COVID-19 pandemic have had devastating effects. They have contributed to reducing economic activity, raising unemployment, reducing schooling, causing political unrest, contributing to domestic violence, and undermining liberal democracy. These costs to society must be compared to the benefits of lockdowns, which our meta-analysis has shown are marginal at best. Such a standard benefit-cost calculation leads to a strong conclusion: lockdowns should be rejected out of hand as a pandemic policy instrument.

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[50] Another case of coincidence is illustrated by Shenoy et al. (2022), who find that areas that experienced rainfall early in the pandemic realized fewer deaths because the rainfall induced social distancing.

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6   Appendix A. The role of timing

Some of the included papers study the importance of the timing of lockdowns, while several other papers only looking at timing of (but not on the inherent effect of) lockdowns have been excluded from the literature list in this review. There's no doubt that being prepared for a pandemic and knowing when it arrives at your doorstep is vital. However, two problems arise with respect to imposing early lockdowns.

First of all, it was virtually impossible to determine the right timing when COVID-19 hit Europe and the United States. The World Health Organization declared the outbreak of a pandemic on 11 March 2020, but at that date Italy had already registered 13.7 COVID-19-deaths per million (all infected before approximately 22 February, because of the roughly 18 day gap between infection and death, c.f. e.g.. Bjørnskov (2021a)). On 29 March 2020, 18 days after WHO declared the outbreak a pandemic and the earliest a lockdown response to WHO's announcement could have an effect, the death toll in Italy was a staggering 178 COVID-19-deaths per million with an additionally 13 per million dying each day.

There are reasons to believe that many countries and regions were hit particularly hard during the first wave of COVID, because they had no clue about how bad it really was. This point is illustrated in Figure 8 (and Figure 9), which show that countries (and states), which were hit hard and early, experienced large death tolls compared to countries where the pandemic had a slower start. Björk et al. (2021) and Arnarson (2021) show that areas with a winter holiday in week 10 and – especially – week 9 were hit hard, because they imported cases from the Alps *before* they knew the pandemic was wide spread at the ski resorts. Hence, while acting early by warning citizens and closing business may be an effective strategy; this was not a feasible strategy for most countries in the spring of 2020.

The second problem is that it is extremely difficult to differentiate between the effect of public awareness and the effect of lockdowns. If people and politicians react to the same information, for example deaths in geographical neighboring countries (many EU-countries reacted to deaths in Italy) or in another part of the same country, the effect of lockdowns cannot easily be separated from the effect of voluntary social distancing or, use of hand sanitizers. Hence, we find it problematic to use national lockdowns and differences in the progress of the pandemic in different regions to say anything about the effect of early lockdowns on the pandemic, as the estimated effect might just as well come from voluntary behavior changes, when people in Southern Italy react to the situation in Northern Italy.

We have seen no studies which we believe credibly separate the effect of early lockdown from the effect of early voluntary behavior changes. Instead, the estimates in these studies capture the effects of lockdowns *and* voluntary behavior changes. As Herby (2021) illustrates, voluntary behavior changes are essential to a society's response to an pandemic and can account for up to 90% of societies' total response to the pandemic.

Including these studies will greatly overestimate the effect of lockdowns, and, hence, we chose not to include studies focusing on timing of lockdowns in our review.

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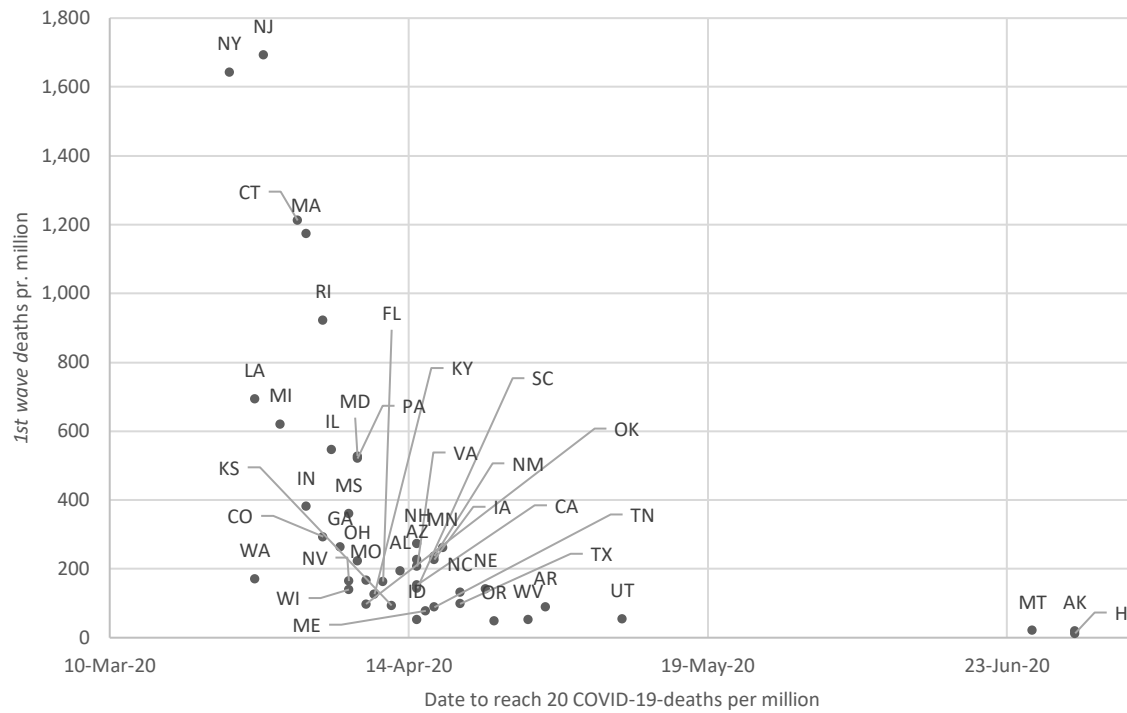**Figure 8: Taken by surprise. The importance of having time to prepare in Europe**
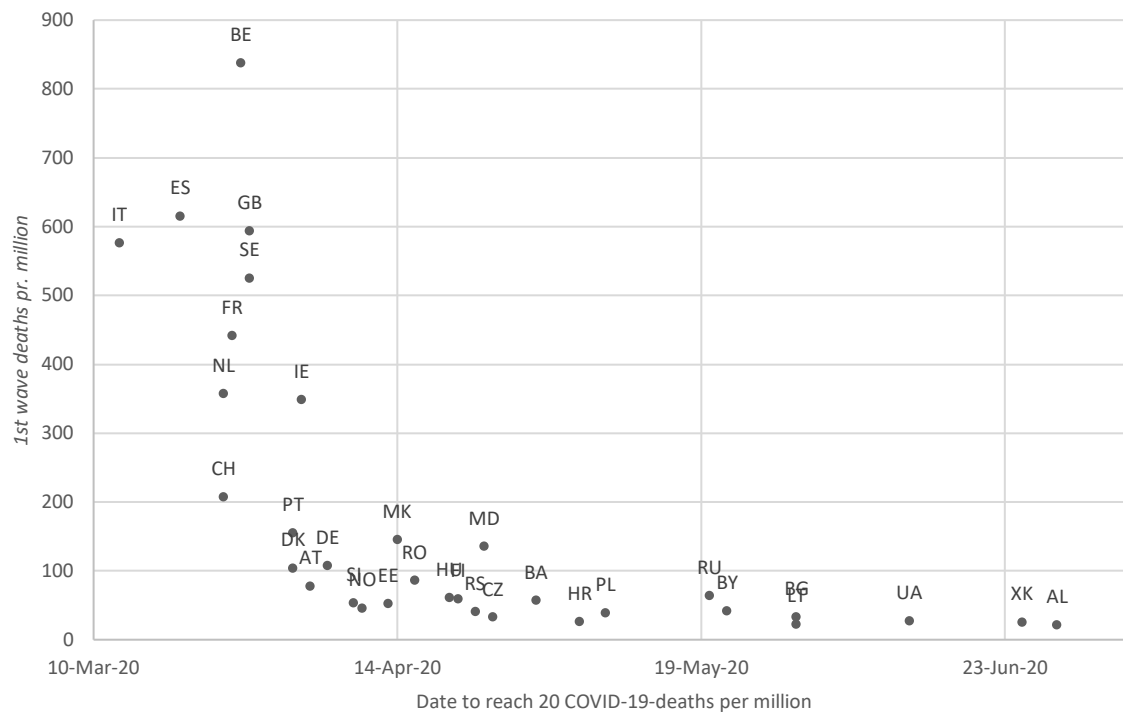
Description: European countries with more than one million citizens.
Source: Our World in Data

Figure 9: Taken by surprise. The importance of having time to prepare in U.S. states

Description: U.S. states with more than one million citizens.
Source: Our World in Data

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7 Appendix B. Supplementary information

7.1 Excluded studies

Below is a list will the studies excluded during the eligibility phase of our identification process and a short description of our basis for excluding the study.

Table 8: Studies excluded during the eligibility phase of our identification process

1. Study (Author & title)	2. Reason for exclusion
Alemán et al. (2020); "Evaluating the effectiveness of policies against a pandemic"	Too few observations
Alshammari et al. (2021); "Are countries' precautionary actions against COVID-19 effective? An assessment study of 175 countries worldwide"	Is purely descriptive
Amuedo-Dorantes et al. (2020); "Timing is Everything when Fighting a Pandemic: COVID-19 Mortality in Spain"	Duplicate
Amuedo-Dorantes et al. (2021); "Early adoption of non-pharmaceutical interventions and COVID-19 mortality"	Only looks at timing
Amuedo-Dorantes, Kaushal and Muchow (2020); "Is the Cure Worse than the Disease? County-Level Evidence from the COVID-19 Pandemic in the United States"	Duplicate
Amuedo-Dorantes, Kaushal and Muchow (2021); "Timing of social distancing policies and COVID-19 mortality: county-level evidence from the U.S."	Only looks at timing
Arruda et al. (2021); "ASSESSING THE IMPACT OF SOCIAL DISTANCING ON COVID-19 CASES AND DEATHS IN BRAZIL: AN INSTRUMENTED DIFFERENCE-IN-	Social distancing (not
Bakolis et al. (2021); "Changes in daily mental health service use and mortality at the commencement and lifting of COVID-19 'lockdown' policy in 10 UK sites: a regression	Uses a time series approach
Bardey, Fernández and Gravel (2021); "Coronavirus and social distancing: do non-pharmaceutical-interventions work (at least) in the short run?"	Only looks at timing
Berardi et. Al. (2020); "The COVID-19 pandemic in Italy: policy and technology impact on health and non-health outcomes"	Too few observations
Bhalla (2020); "Lockdowns and Closures vs COVID–19: COVID Wins"	Uses modelling
Björk et al. (2021); "Impact of winter holiday and government responses on mortality in Europe during the first wave of the COVID-19 pandemic"	Only looks at timing
Bongaerts, Mazzola and Wagner (2020); "Closed for business"	Duplicate
Born, Dietrich and Müller (2021); "The lockdown effect: A counterfactual for Sweden"	Synthetic control study
Born, Dietrich and Müller (2021); "The lockdown effect: A counterfactual for Sweden"	Duplicate
Bushman et al. (2020); "Effectiveness and compliance to social distancing during COVID-19"	Social distancing (not
Castaneda and Saygili (2020); "The effect of shelter-in-place orders on social distancing and the spread of the COVID-19 pandemic: a study of Texas"	Uses a time series approach
Cerqueti et al. (2021); "The sooner the better: lives saved by the lockdown during the COVID-19 outbreak. The case of Italy"	Synthetic control study
Chernozhukov, Kasahara and Schrimpf (2021); "Mask mandates and other lockdown policies reduced the spread of COVID-19 in the U.S."	Duplicate
Chin et al. (2020); "Effects of non-pharmaceutical interventions on COVID-19: A Tale of Three Models"	Uses modelling
Cho (2020); "Quantifying the impact of nonpharmaceutical interventions during the COVID-19 outbreak: The case of Sweden"	Synthetic control study
Coccia (2020); "The effect of lockdown on public health and economic system: findings from first wave of the COVID-19 pandemic for designing effective strategies to cope	Only looks at timing
Coccia (2021); "Different effects of lockdown on public health and economy of countries: Results from first wave of the COVID-19 pandemic"	Too few observations
Conyon and Thomsen (2021); "COVID-19 in Scandinavia"	Synthetic control study
Conyon et al. (2020); "Lockdowns and COVID-19 deaths in Scandinavia"	Too few observations
Dave et al. (2020); "Did the Wisconsin Supreme Court restart a COVID-19 epidemic? Evidence from a natural experiment"	Synthetic control study
Delis, Iosifidi and Tasiou (2021); "Efficiency of government policy during the COVID-19 pandemic"	Do not look at mortality
Dreher et al. (2021); "Policy interventions, social distancing, and SARS-CoV-2 transmission in the United States: a retrospective state-level analysis"	Do not look at mortality
Duchemin, Veber and Boussau (2020); "Bayesian investigation of SARS-CoV-2-related mortality in France"	Uses modelling
Fair et. Al. (2021); "Estimating COVID-19 cases and deaths prevented by non-pharmaceutical interventions in 2020-2021, and the impact of individual actions: a retrospective	Uses modelling
Filias (2020); "The impact of government policies effectiveness on the officially reported deaths attributed to covid-19."	Student paper
Fowler et al. (2021); "Stay-at-home orders associate with subsequent decreases in COVID-19 cases and fatalities in the United States"	Duplicate
Friedson et al. (2020); "Did California's shelter-in-place order work? Early coronavirus-related public health effects"	Duplicate
Friedson et al. (2020); "Shelter-in-place orders and public health: evidence from California during the COVID-19 pandemic"	Synthetic control study
Fuss, Weizman and Tan (2020); "COVID19 pandemic: how effective are interventive control measures and is a complete lockdown justified? A comparison of countries and	Do not look at mortality
Ghosh, Ghosh and Narymanchi (2020); "A Study on The Effectiveness of Lock-down Measures to Control The Spread of COVID-19"	Synthetic control study
Glogowsky et al. (2021); "How Effective Are Social Distancing Policies? Evidence on the Fight Against COVID-19"	Only looks at timing
Glogowsky, Hansen and Schächtele (2020); "How effective are social distancing policies? Evidence on the fight against COVID-19 from Germany"	Duplicate
Glogowsky, Hansen and Schächtele (2020); "How Effective Are Social Distancing Policies? Evidence on the Fight Against COVID-19 from Germany"	Duplicate
Gordon, Grafton and Steinshamn (2021); "Cross-country effects and policy responses to COVID-19 in 2020: The Nordic countries"	Do not look at mortality
Gordon, Grafton and Steinshamn (2021); "Statistical Analyses of the Public Health and Economic Performance of Nordic Countries in Response to the COVID-19 Pandemic"	Too few observations
Guo et al. (2020); "Social distancing interventions in the United States: An exploratory investigation of determinants and impacts"	Duplicate
Huber and Langen (2020); "The impact of response measures on COVID-19-related hospitalization and death rates in Germany and Switzerland"	Duplicate
Huber and Langen (2020); "Timing matters: the impact of response measures on COVID-19-related hospitalization and death rates in Germany and Switzerland"	Only looks at timing
Jain et al. (2020); "A comparative analysis of COVID-19 mortality rate across the globe: An extensive analysis of the associated factors"	Do not look at mortality
Juranek and Zoutman (2021); "The effect of non-pharmaceutical interventions on the demand for health care and mortality: evidence on COVID-19 in Scandinavia"	Too few observations
Kakpo and Nuhu (2020); "Effects of Social Distancing on COVID-19 Infections and Mortality in the U.S."	Social distancing (not
Kapoor and Ravi (2020); "Impact of national lockdown on COVID-19 deaths in select European countries and the U.S. using a Changes-in-Changes model"	Too few observations
Khatiwada and Chalise (2020); "Evaluating the efficiency of the Swedish government policies to control the spread of Covid-19."	Student paper
Korevaar et al. (2020); "Quantifying the impact of U.S. state non-pharmaceutical interventions on COVID-19 transmission"	Do not look at mortality
Kumar et. Al. (2020); "Prevention-Versus Promotion-Focus Regulatory Efforts on the Disease Incidence and Mortality of COVID-19: A Multinational Diffusion Study Using	Do not look at mortality
Le et al. (2020); "Impact of government-imposed social distancing measures on COVID-19 morbidity and mortality around the world"	Uses a time series approach
Liang et al. (2020); "Covid-19 mortality is negatively associated with test number and government effectiveness"	Not effect of lockdowns
Mader and Rütternauer (2021); "The effects of non-pharmaceutical interventions on COVID-19-related mortality: A generalized synthetic control approach across 169 countries"	Synthetic control study
Matzinger and Skinner (2020); "Strong impact of closing schools, closing bars and wearing masks during the Covid-19 pandemic: results from a simple and revealing analysis"	Uses modelling
Mccafferty and Ashley (2020); "Covid-19 Social Distancing Interventions by State Mandate and their Correlation to Mortality in the United States"	Duplicate
Medline et al. (2020); "Evaluating the impact of stay-at-home orders on the time to reach the peak burden of Covid-19 cases and deaths: does timing matter?"	Only looks at timing

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1. Study (Author & title)	2. Reason for exclusion
Mu et al. (2020); "Effect of social distancing interventions on the spread of COVID-19 in the state of Vermont"	Uses modelling
Nakamura (2020); "The Impact of Rapid State Policy Response on Cumulative Deaths Caused by COVID-19"	Student paper
Neidhöfer and Neidhöfer (2020); "The effectiveness of school closures and other pre-lockdown COVID-19 mitigation strategies in Argentina, Italy, and South Korea"	Synthetic control study
Oliveira (2020); "Does' Staying at Home' Save Lives? An Estimation of the Impacts of Social Isolation in the Registered Cases and Deaths by COVID-19 in Brazil"	Social distancing (not
Palladina et al. (2020); "Effect of Implementation of the Lockdown on the Number of COVID-19 Deaths in Four European Countries"	Uses a time series approach
Palladina et al. (2020); "Effect of timing of implementation of the lockdown on the number of deaths for COVID-19 in four European countries"	Duplicate
Palladino et al. (2020); "Excess deaths and hospital admissions for COVID-19 due to a late implementation of the lockdown in Italy"	Uses a time series approach
Peixoto et al. (2020); "Rapid assessment of the impact of lockdown on the COVID-19 epidemic in Portugal"	Uses modelling
Piovani et. Al. (2021); "Effect of early application of social distancing interventions on COVID-19 mortality over the first pandemic wave: An analysis of longitudinal data from 37	Only looks at timing
Reinbold (2021); "Effect of fall 2020 K-12 instruction types on CoViD-19 cases, hospital admissions, and deaths in Illinois counties"	Synthetic control study
Renne, Roussellet and Schwenkler (2020); "Preventing COVID-19 Fatalities: State versus Federal Policies"	Uses modelling
Siedner et al. (2020); "Social distancing to slow the U.S. COVID-19 epidemic: Longitudinal pretest–posttest comparison group study"	Duplicate
Siedner et al. (2020); "Social distancing to slow the U.S. COVID-19 epidemic: Longitudinal pretest–posttest comparison group study"	Uses a time series approach
Silva, Filho and Fernandes (2020); "The effect of lockdown on the COVID-19 epidemic in Brazil: evidence from an interrupted time series design"	Uses a time series approach
Stamam et al. (2020); "IMPACT OF LOCKDOWN MEASURE ON COVID-19 INCIDENCE AND MORTALITY IN THE TOP 31 COUNTRIES OF THE WORLD."	Uses a time series approach
Steinegger et al. (2021); "Retrospective study of the first wave of COVID-19 in Spain: analysis of counterfactual scenarios"	Only looks at timing
Stephens et al. (2020); "Does the timing of government COVID-19 policy interventions matter? Policy analysis of an original database."	Only looks at timing
Supino et al. (2020); "The effects of containment measures in the Italian outbreak of COVID-19"	Uses a time series approach
Timelli and Girardi (2021); "Effect of timing of implementation of containment measures on Covid-19 epidemic. The case of the first wave in Italy"	Only looks at timing
Trivedi and Das (2020); "Effect of the timing of stay-at-home orders on COVID-19 infections in the United States of America"	Only looks at timing
Umer and Khan (2020); "Evaluating the Effectiveness of Regional Lockdown Policies in the Containment of Covid-19: Evidence from Pakistan"	Too few observations
VoPham et al. (2020); "Effect of social distancing on COVID-19 incidence and mortality in the U.S."	Do not look at mortality
Wu and Wu (2020); "Stay-at-home and face mask policies intentions inconsistent with incidence and fatality during U.S. COVID-19 pandemic"	Too few observations
Xu et al. (2020); "Associations of Stay-at-Home Order and Face-Masking Recommendation with Trends in Daily New Cases and Deaths of Laboratory-Confirmed COVID-19 in	Do not look at mortality
Yehya, Venkataramani and Harhay (2020); "Statewide Interventions and Coronavirus Disease 2019 Mortality in the United States: An Observational Study"	Only looks at timing
Ylli et al. (2020); "The lower COVID-19 related mortality and incidence rates in Eastern European countries are associated with delayed start of community circulation Alban	Not effect of lockdowns

7.2   Interpretation of estimates and conversion to common estimates

In Table 9, we describe for each study used in the meta-analysis how we interpret their results and convert the estimates to our common estimate. Standard errors are converted such that the t-value, calculated based on common estimates and standard errors, is unchanged. When confidence intervals are reported rather than standard errors, we calculate standard errors using t-distribution with ∞ degrees of freedom (i.e. 1.96 for 95% confidence interval).

Table 9: Notes on studies included in the meta-analysis

1. Study (Author & title)	2. Date Published	3. Journal	4. Comments regarding meta-analysis
Alderman and Harjoto (2020); "COVID-19: U.S. shelter-in-place orders and demographic characteristics linked to cases, mortality, and recovery rates"	26-Nov-20	Transforming Government: People, Process and Policy	We use the 1% effect noted by the authors in "We find that the natural log of the duration (in days) that the state instituted shelter-in-place reduces percentages of mortality by 0.0001%, or approximately 1% of the means of percentages of deaths per capita in our sample. The standard error is calculated on basis of the t-value in Table 3.
Aparicio and Grossbard (2021); "Are Covid Fatalities in the U.S. Higher than in the EU, and If so, Why?"	16-Jan-21	Review of Economics of the Household	We use estimates from Table 3, model 5. For each estimate the common estimate is calculated as (difference in COVID-19 mortality with NPI)/(difference in COVID-19 mortality without NPI)-1, where (difference in COVID-19 mortality with NPI) is 237.89 (Table 2 states that deaths per million is 406.99 in U.S. and 169.10 in Europe) and (difference in COVID-19 mortality without NPI) is estimated as exp(ln(difference in COVID-19 mortality with NPI)-estimate).
Ashraf (2020); "Socioeconomic conditions, government interventions and health outcomes during COVID-19"	1-Jul-20	ResearchGate	It is unclear whether they prefer the model with or without the interaction term. In the meta-analysis, we use an average of -0.326 (Table 3, without) and -0.073 (Table 6, with) deaths per million per stringency point (i.e. -0.200). The common estimate is the average effect in Europe and United States respectively calculated as (Actual COVID-19 mortality) / (COVID-19 mortality with recommendation policy) -1, where (COVID-19 mortality with recommendation policy) is calculated as ((Actual COVID-19 mortality) - Estimate x Difference in stringency x population). Stringencies in Europe and United States are equal to the average stringency from March 16th to April 15th 2020 (76 and 74 respectively) and the stringency for the policy based solely on recommendations is 44 following Hale et al. (2020).

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1. Study (Author & title)	2. Date Published	3. Journal	4. Comments regarding meta-analysis
Auger et al. (2020); "Association between statewide school closure and COVID-19 incidence and mortality in the U.S."	1-Sep-20	JAMA	Estimate that school closure was associated with a 58% decline in COVID-19 mortality and that the effect was largest in states with low cumulative incidence of COVID-19 at the time of school closure. States with the lowest incidence of COVID-19 had a −72% relative change in incidence compared with −49% for those states with the highest cumulative incidence.
Berry et al. (2021); "Evaluating the effects of shelter-in-place policies during the COVID-19 pandemic"	24-Feb-21	PNAS	The estimated effect of SIPO's, an increase in deaths by 0,654 per million after 14 days (significant, cf. Fig. 2), is converted to a relative effect on a state basis based on data from OurWorldInData. For states which did implement SIPO, we calculate the number of deaths without SIPO as the number of official COVID-19 deaths 14 days after SIPO was implemented minus 0,654 extra deaths per million. For states which did not implement SIPO, we calculate the number of deaths with SIPO as the number of official COVID-19 deaths 14 days after March 31 2020 plus 0,654 extra deaths per million. We use March 31 2020 as this was the average date on which SIPO was implemented in the 40 states which did implement SIPO. Using this approximation, the effect of SIPO's in the U.S. is 1,1% more deaths after 14 days. Common standard errors are not available.
Bjørnskov (2021a); "Did Lockdown Work? An Economist's Cross-Country Comparison"	29-Mar-21	CESifo Economic Studies	We use estimates from Table 2 (four weeks). Common estimate is calculated as the average of the effect in Europe and United States, where the effect for each is calculated as (ln(policy stringency) - ln(recommendation stringency)) x estimate.
Blanco et al. (2020); "Do Coronavirus Containment Measures Work? Worldwide Evidence"	1-Dec-20	World Bank Group	The study is not included in the meta-analysis, as it looks at the effect of NPIs on growth rates and does not include an estimate of the effect on total mortality.
Bonardi et al. (2020); "Fast and local: How did lockdown policies affect the spread and severity of the covid-19"	8-Jun-20	0	Find that, world-wide, internal NPIs have prevented about 650,000 deaths (3.11 deaths were prevented for each death that occurred, i.e. 76% effect). However, this effect is for any lockdown including a Swedish lockdown. They do not find an extra effect of stricter lockdowns and state that "our results point to the fact that people might adjust their behaviors quite significantly as partial measures are implemented, which might be enough to stop the spread of the virus." Hence, whether the baseline is Sweden, which implemented a ban on large gatherings early in the pandemic, or the baseline is "doing nothing" can affect the magnitude of the estimated impacts. Since all Western countries did something and estimates in other reviewed studies are relative to doing less – and, hence not to doing nothing, we report the result from Bonardi et al. as compared to "doing less." Hence, for Bonardi et al. we use 0% as the common estimate in the meta-analysis for each NPI (SIPO, regional lockdown, partial lockdown, and border closure (stage 1, stage 2 and full) because all NPIs are insignificant (compared to Sweden's "doing the least"-lockdown).
Bongaerts et al. (2021); "Closed for business: The mortality impact of business closures during the Covid-19 pandemic"	14-May-21	PLOS ONE	Business shutdown saved 9,439 Italian lives by 13th 2020. This corresponds to 32%, as there were 20,465 COVID-19-deaths in Italy by mid April 2020.
Chaudhry et al. (2020); "A country level analysis measuring the impact of government actions, country preparedness and socioeconomic factors on COVID-19 mortality and related health outcomes"	1-Aug-20	EClinacal-Medicine	Finds no effect of partial border closure, complete border closure, partial lockdown (physical distancing measures only), complete lockdown (enhanced containment measures including suspension of all non-essential services), and curfews. In the meta-analysis we use a common estimate of 0%, as estimates and standard errors are not available.
Chernozhukov et al. (2021); "Causal impact of masks, policies, behavior on early covid-19 pandemic in the U.S."	1-Jan-21	Journal of Econometrics	The study looks at the effect of NPIs on growth rates but does include an estimate of the effect on total mortality at the end of the study period for employee face masks (-34%), business closure (-29%). and SIPO (-18%), but not for school closures (which we therefore exclude). In reporting the results of their counterfactual, they alter between "fewer deaths with NPI" and "more deaths without NPI." We have converted the latter to the former as estimate/(1+estimate) so "without business closures deaths would be about 40% higher" corresponds to "with business closures deaths would be about 29% lower."
Chisadza et al. (2021); "Government Effectiveness and the COVID-19 Pandemic"	10-Mar-21	MDPI	The common estimate is the average effect in Europe and United States respectively calculated as (Actual COVID-19 mortality) / (COVID-19 mortality with recommendation policy) -1, where (COVID-19 mortality with recommendation policy) is calculated as ((Actual COVID-19 mortality) - Estimate x Difference in stringency x population). Stringencies in Europe and United States are equal to the average stringency from March 16th to April 15th 2020 (76 and 74 respectively) and the stringency for the policy based solely on recommendations is 44 following Hale et al. (2020). In the meta-analysis we use the non-linear estimate, but the squared estimate yields similar results.
Dave et al. (2021); "When Do Shelter-in-Place Orders	3-Aug-20	Economic Inpuiry	The study looks at the effect of SIPO's on growth rates but does include an estimate of the effect on total mortality after 20+ days for model 1 and 2 in Table 7. Since model 3, 4 and 5 have estimates

1. Study (Author & title)	2. Date Published	3. Journal	4. Comments regarding meta-analysis
Fight Covid-19 Best? Policy Heterogeneity Across States and Adoption Time"			similar to model 2, we use an average of model 1 to 5, where the estimates of model 3 to 5 are calculated as (common estimate model 2) / (estimate model 2) x estimate model 3/4/5.
Dergiades et al. (2020); "Effectiveness of government policies in response to the COVID-19 outbreak"	28-Aug-20	SSRN	The study is not included in the meta-analysis, as it looks at the effect of NPIs on growth rates and does not include an estimate of the effect on total mortality.
Fakir and Bharati (2021); "Pandemic catch-22: The role of mobility restrictions and institutional inequalities in halting the spread of COVID-19"	28-Jun-21	PLOS ONE	The study is not included in the meta-analysis, as it looks at the effect of NPIs on growth rates and does not include an estimate of the effect on total mortality.
Fowler et al. (2021); "Stay-at-home orders associate with subsequent decreases in COVID-19 cases and fatalities in the United States"	10-Jun-21	PLOS ONE	The study looks at the effect of SIPO's on growth rates but does include an estimate of the effect on total mortality after three weeks (35% reduction in deaths) which is used in the meta-analysis.
Fuller et al. (2021); "Mitigation Policies and COVID-19–Associated Mortality — 37 European Countries, January 23–June 30, 2020"	15-Jan-21	Morbidity and Mortality Weekly Report	For each 1-unit increase in OxCGRT stringency index, the cumulative mortality decreases by 0.55 deaths per 100,000. The common estimate is the average effect in Europe and United States respectively calculated as (Actual COVID-19 mortality) / (COVID-19 mortality with recommendation policy) -1, where (COVID-19 mortality with recommendation policy) is calculated as ((Actual COVID-19 mortality) - Estimate x Difference in stringency x population). Stringencies in Europe and United States are equal to the average stringency from March 16th to April 15th 2020 (76 and 74 respectively) and the stringency for the policy based solely on recommendations is 44 following Hale et al. (2020).
Gibson (2020); "Government mandated lockdowns do not reduce Covid-19 deaths: implications for evaluating the stringent New Zealand response"	18-Aug-20	New Zealand Economic Papers	We use the two graphs to the left in figure 3, where we extract the data from the rightmost datapoint (I.e. % impact of county lockdowns on Covid-19 deaths by 1/06/2020). We then take the average of the estimates found in the two graphs, because it is unclear which estimate the author prefers.
Goldstein et al. (2021); "Lockdown Fatigue: The Diminishing Effects of Quarantines on the Spread of COVID-19 "	4-Feb-21	CID Faculty Working	We convert the effect in Figure 4 after 90 days (log difference -1.16 of a standard deviation change) to deaths per million per stringency following footnote 3 (the footnote says "weekly deaths," but we believe this should be "daily deaths"), so the effect is $e^{-1.16} - 1 = -0.69$ decline in daily deaths per million per SD. We convert to total effect by multiplying with 90 days and "per point" by dividing with SD = 22.3 (corresponding to the SD for the 147 countries with data before March 19, 2020 - using all data yields similar results) yielding -2.77 deaths per million per stringency point. The common estimate is the average effect in Europe and United States respectively calculated as (Actual COVID-19 mortality) / (COVID-19 mortality with recommendation policy) -1, where (COVID-19 mortality with recommendation policy) is calculated as ((Actual COVID-19 mortality) - Estimate x Difference in stringency x population). Stringencies in Europe and United States are equal to the average stringency from March 16th to April 15th 2020 (76 and 74 respectively) and the stringency for the policy based solely on recommendations is 44 following Hale et al. (2020).
Guo et al. (2021); "Mitigation Interventions in the United States: An Exploratory Investigation of Determinants and Impacts"	21-Sep-20	Research on Social Work Practice	We use estimates for "Proportion of Cumulative Deaths Over the Population" (per 10,000) in Table 3. We interpret this number as the change in cumulative deaths over the population in percent and is therefore the same as our common estimate.
Hale et al. (2020); "Global assessment of the relationship between government response measures and COVID-19 deaths"	6-Jul-20	medRxiv	The study is not included in the meta-analysis, as it looks at the effect of NPIs on growth rates and does not include an estimate of the effect on total mortality. They ascertain that "sustained over three months, this would correspond to a cumulative number of deaths 30% lower," however this is not a counterfactual estimate and three months goes beyond the period they have data for.
Hunter et al. (2021); "Impact of non-pharmaceutical interventions against COVID-19 in Europe: A quasi-experimental non-equivalent group and time-series"	15-Jul-21	Eurosurveillance	The study is not included in the meta-analysis, as they report the effect of NPIs in incident risk ratio which are not easily converted to relative effects.

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1. Study (Author & title)	2. Date Published	3. Journal	4. Comments regarding meta-analysis
Langeland et al. (2021); "The Effect of State Level COVID-19 Stay-at-Home Orders on Death Rates"	5-Mar-21	Culture & Crisis Conference	The study is not included in the meta-analysis, as it looks at the effect of NPIs on odds-ratios and does not include an estimate of the effect on total mortality.
Leffler et al. (2020); "Association of country-wide coronavirus mortality with demographics, testing, lockdowns, and public wearing of masks"	26-Oct-20	ASTMH	Their "mask recommendation" includes some countries, where masks were mandated and may (partially) capture the effect of mask mandates. However, the authors' focus is on recommendation, so we do interpret their result as a voluntary effect - not an effect of mask mandate. Using estimates from Table 2 and assuming NPIs were implemented March 15 (8 weeks in total by end of study period), common estimates are calculated as 8^est-1.
Mccafferty and Ashley (2021); "Covid-19 Social Distancing Interventions by Statutory Mandate and Their Observational Correlation to Mortality in the United States and Europe"	27-Apr-21	Pragmatic and Observational Research	The study is not included in the meta-analysis, as it looks at the effect of NPIs on peak mortality and does not include an estimate of the effect on total mortality.
Pan et al. (2020); "Covid-19: Effectiveness of non-pharmaceutical interventions in the united states before phased removal of social distancing protections varies by region"	20-Aug-20	medRxiv	The study is not included in the meta-analysis, as the cluster the NPIs (e.g. SIPO, mask mandata amd travel restricions are clustered in Level 4).
Pincombe et al. (2021); "The effectiveness of national-level containment and closure policies across income levels during the COVID-19 pandemic: an analysis of 113 countries"	4-May-21	Health Policy and Planning	Policy implementations were assigned according to the first day that a country received a policy stringency rating above 0 in the OxCGRT stay-at-home measure. As the value 1 is a recommendation "recommend not leaving house," we cannot distinguish recommendations from mandates, and, thus, the study is not included in the meta-analysis.
Sears et al. (2020); "Are we #stayinghome to Flatten the Curve?"	6-Aug-20	medRxiv	Find that SIPOs lower mortality by 29-35%. We use the average (32%) as our common estimate. Common standard errors are calculated based on estimates and standard errors from (Table 4) assuming they are linearly related to estimates.
Shiva and Molana (2021); "The Luxury of Lockdown"	9-Apr-21	The European Journal of Development Research	The estimate with 8 weeks lag is insignificant, and preferable given our empirical strategy. However, they use the 4-week lag when elaborating the model to differentiate between high- and low-income countries, so the 4-week lag estimate for rich countries is used in our meta-analysis. Common estimate is calculated as the average of the effect in Europe and United States, where the effect for each is calculated as (policy stringency - recommendation stringency) x estimate.
Spiegel and Tookes (2021); "Business restrictions and Covid-19 fatalities"	18-Jun-21	The Review of Financial Studies	We use weighted average of estimates for Table 4, 6, and 9. Since authors state that they place more weight on the findings in Table 9, Table 9 weights by 50% while Table 4 and 6 weights by 25%. We estimate the effect on total mortality from effect on growth rates based on authors calculation showing that estimates of -0.049 and -0.060 reduces new deaths by 12.5% 15.3% respectively. We use the same relative factor on other estimates.
Stockenhuber (2020); "Did We Respond Quickly Enough? How Policy-Implementation Speed in Response to COVID-19 Affects the Number of Fatal Cases in Europe"	10-Nov-20	World Medical & Health Policy	When calculating arithmetic average / median, the study is included as 0%, because estimates in Table 6 are insignificant and signs of estimates are mixed (higher strictness can cause both fewer and more deaths). We don't calculate common standard errors.
Stokes et al. (2020); "The relative effects of non-pharmaceutical interventions on early Covid-19 mortality: natural experiment in 130 countries"	6-Oct-20	medRxiv	We use estimates from regression on strictness alone (Right panel in Table "Regression results, policy strictness. Baseline is "policy not introduced within policy analysis period" in "Additional file"). We use the average of 24 and 38 days from model 5. There are 23 relevant estimates in total (they analyze all levels within the eight NPI measures in the OxCGRT stringency index). We calculate the effect of each NPI (e.g. closing schools) as the average effect in all of U.S./Europe. This is done by calculating the effect for each state/country based on the maximum level for each measure between Mar 16 and Apr 15 (e.g. if all schools in a state/country are required to close (school closing level 3) the relevant estimate for that state/level is -0.031 (average of -0.464 and 0.402). We assume all NPIs are effective for 54 days (from March 15 to June 1 minus 24 days to reach full effect). Standard errors are converted to common standard errors following the same process (this approach is unique for Stokes, as our general approach is not possible).

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1. Study (Author & title)	2. Date Published	3. Journal	4. Comments regarding meta-analysis
Toya and Skidmore (2020); "A Cross-Country Analysis of the Determinants of Covid-19 Fatalities"	1-Apr-20	CESifo Working Papers	It is unclear how they define "lockdown." They write that "many countries [...] imposed lockdowns of varying degrees, some imposing mandatory nationwide lockdowns, restricting economic and social activity deemed to be non-essential," and since all European countries and all states in the U.S. imposed restrictions on economic (closing unessential businesses) and/or social (limiting large gatherings) activity, we interpret this as all European countries and all U.S. states had mandatory nationwide lockdowns. The effect of recommended lockdowns is set to zero in the meta-analysis, as only one country was in this lockdown category (i.e. too few observations, cf. eligibility criteria). The estimate for complete travel closure is -0.226 COVID-deaths per 100,000. Hence, if all of Europe imposed complete travel closure, the total effect would be -0.266 * 748 million (population) * 10 (100,000/1,000,000) equal to 1,690 averted COVID-19 deaths. However, according to OxCGRT-data European countries only had complete travel bans (Level 4: "Ban on all regions or total border closure") in 11% of the time between March 16 and April 15, 2020. So the total effect is 1,690 * 11% = 194 averted deaths. During the first wave 188,000 deaths in Europe was related to COVID-19 (by June 30, 2020), so the total effect is approximated to -0.1% in Europe and, following the same logic, 0% in U.S., where no states closed their borders completely. We use the average, -0.05%, in the meta-analysis. The estimate for mandatory national lockdown is 0.166 (>0) COVID-deaths per 100,000. Since all European countries (and U.S. states) imposed lockdowns, the total effect is 1,241 (553) extra COVID-19 deaths corresponding to 0.7% (0.4%). We use the average of Europe and the U.S., 0.5%, in the meta-analysis. Calculations of the effect of "Mandatory national lockdown" follow the same logic, but we assume 100% of Europe and United States have had "Mandatory national lockdown."
Tsai et al. (2021); "Coronavirus Disease 2019 (COVID-19) Transmission in the United States Before Versus After Relaxation of Statewide Social Distancing Measures"	3-Oct-20	Oxford academic	The study is not included in the meta-analysis, as they report the effect of NPIs on Rt which are not easily converted to relative effects.

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Over to Health for response.

Thank you,

Sheri Forsythe
Correspondence Coordinator / Coordinatrice de la correspondance
Office of the Premier/Cabinet du premier ministre

From: 21(1)

Sent: Thursday, February 17, 2022 9:20 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Cc: Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>
Subject: Unmask the Children

ATTENTION! External email / courriel externe.

Dear Mr. Higgs,

As stated in my previous emails I am a teacher and a mother of two school aged children. I am prompted to write this email to you today after seeing a grade three student wearing a reusable mask that had a very visible black circle around the mouth area. Her teacher confirmed that she wears this mask all day every day. This little girl lives in the trailer park and has three siblings who also attend school. I am quite sure her parents cannot afford disposable masks for their children and cannot keep up with washing their masks, if they even have a washing machine.

Schools recommend that children have two masks for their school day, and sadly many do not even have this. In reality, a child needs at least five masks during the school day in order to ensure they are not wearing a wet, soiled, bacteria filled mask. Let's take a look at why children need at least five masks.

Mask number one- the child needs to put a mask on in the morning before boarding the bus. The child then plays outside on the playground at school until the morning bell rings. Their mask is now wet from their breath.   A wet mask needs to be changed.
Mask number two- the child enters the school and should remove their wet mask. The student sits in class, eats snack, goes back outside. Mask is wet again after playing outside.
Mask number three- the child enters the school and needs to change wet mask. More class time, then lunch, then back outside in the cold weather. Mask is wet again.

Mask number four- the child needs to change the wet mask again.
Mask number five- Inevitably some time though out the school day a child will drop their mask on the floor, sneeze into their mask, loose a tooth or bite their lip and blood gets on mask...

As you can see, in order for a child to be wearing a clean mask during their school day, they actually require five masks a day, or twenty five masks a week. So a family with four children would need one hundred masks a week to safely protect their children from bacteria. This is an insane burden on parents to have to buy these masks or launder them nightly.

I'm not even going to get into the developmental delays and mental trauma these masks are causing children. I am quite sure you are well aware of the negative effects of masks on children. If not, I encourage you to visit a classroom and observe the children that you are enforcing your mandates on.

Stop the insanity. Enough is enough. Unmask the children.

Sincerely,

21(1)

Get Outlook for iOS

From: 21(1)
Sent: Sunday, February 20, 2022 9:13:23 AM
To: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>
Subject: Level 1

ATTENTION! External email / courriel externe.

Dear Dr. Russell
I am writing as a concerned parent. Level 1 does nothing for our children being masked all day at school. 2 years ago the world health organization put out info how it isn't healthy for children to be masked and here we are 2 years later and you still want them masked. The mask causes greater concern for me then covid. So far since school started in September my child has been on a puffer .. antibiotics and nasal spray. She comes home everyday so stuffed up. Can you seriously tell me they are healthy for kids to wear?? The majority has done what was asked get vaccinated vaccinate our children even if we didn't want to why cause we believed you and thought things might change. Well now the majority is annoyed and sick of the bull crap. We did our part now do yours. If kids want to wear mask fine but give the kids an option in the gym for phys Ed class and outside. Would love to see this revision to level one. The majority that listened is fed up and obviously if people haven't got vaccinated yet they aren't going to no way you are changing their mind now so give it up and move on. My child says she doesn't want to go to school and wear a mask all day inside and out. She's 5 she is suppose to love school not cry because she doesn't want to be masked all day. You are causing these young children more mental health issues then you know and it's very sad. You are a mother think about it from a mother's point of view not a politicians
Thanks and please consider making this change to level 1 it's not asking that much and I know Mr Higgs has received other email from upset parents about the mask . Time to consider a revision to level 1 please I'm begging you. It's so sad when your child doesn't want to go to school. Sad world these little ones are growing up in

--
Sent from myMail for Android

127

Please prepare a response for the Premier's signature.

Thank you,

Sheri Forsythe
Correspondence Coordinator/Coordinatrice de la correspondance
Office of the Premier/Cabinet du premier ministre

-----Original Message-----
From: 21(1)
Sent: Tuesday, February 22, 2022 3:49 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Mandates

ATTENTION! External email / courriel externe.

Mr Higgs,

These mandates need to stop!! Our kids need their lives back. They need to be able to go to school without the worry of wearing masks or not being able to participate in activities because of their vaccination status. So many kids are being bullied and losing friendships. All because they don't have a vaccination or because that may not being wearing a mask right. This needs to end NOW!!! If you had the slightest idea what it is like to watch a child's mental health deteriorate because of the madness you would understand the people and be a voice for us not against us. Just remember one thing, it was the people that voted you in and it will be the people that can make sure you don't get back in. Good day sir and may god bless

P.S I will be send this email everyday until I receive back a response. Eventually I will be in contact with the media to see if they can find out why elected officials won't respond to concerns of the public. I've have contacted 2 other conservative members with no response. Not going to look good for the conservatives when this is brought to the media.

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Dancing Without A Mask.
Date:	February 28, 2022 8:58:13 AM

Please prepare a response for the Premier's signature.

Thank you,

Sheri Forsythe
Correspondence Coordinator/Coordinatrice de la correspondance
Office of the Premier/Cabinet du premier ministre

-----Original Message-----
From: 21(1)
Sent: Friday, February 25, 2022 1:15 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Dancing Without A Mask.

Dear, Premier Higgs

As a resident of Miramichi I am taking my time to write to you today because it is not healthy for your mental health nor your physical health to be wearing masks during physical activities.

First of all, a mask can restrict the flow of air into your lungs. If you wear one while exercising, you will feel breathless sooner than normal.

Also, wearing a mask could give very bad lung problems, heart problems, physical and mental problems and more, so I would suggest being able to take them off. For example, like when I'm 21(1) The mask makes me feel restricted, sweatier than normal and makes my face and mask damp. But, without it I can breathe, not be as sweaty, and my face does not get damp.

In conclusion, you now should see my point of view, thank you for reading this email on physical activity.

Sincerely,

21(1)

From:	Crain, Krista (DH/MS) on behalf of Shephard, Dorothy Hon. (DH/MS)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Concerned parent
Date:	March 2, 2022 9:32:29 AM
Attachments:	ama-section-of-pediatrics-letter-re-public-health-protections-feb-15-2022.pdf

From: 21(1)
Sent: Wednesday, March 2, 2022 5:31 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>; Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>; Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>
Subject: Concerned parent

ATTENTION! External email / courriel externe.

March 2, 2022 Honourable Blain Higgs Premier Honourable Dorothy Shephard Minister of Health Honourable Dominic Cardy Minister of Education
Dear Premier Higgs, Minister Sheppard, and Minister Cardy,
I believe along with the Canadian Pediatrics Society as indicated in the attached letter that mask usage is critical in New Brunswick schools to reduce the spread of COVID-19 in communities and to prevent hospitals from reaching capacity.
As a concerned parent, I am very disturbed that the health and safety of our children and families is no longer a concern to the government.
Thank you for your attention,

21(1)

In these connected times, it may suit me to send an email at this time, however I do not expect to receive a reply outside of your working hours.
En ces temps branchés, bien que cela me convient de vous envoyer un message maintenant, je ne m'attends pas à recevoir une réponse en dehors de vos heures de travail.

February 15, 2022

Honourable Jason Kenney
Premier
Premier@gov.ab.ca

Honourable Jason Copping
Minister of Health
Health.minister@gov.ab.ca

Honourable Adriana LaGrange
Minister of Education
Education.minister@gov.ab.ca

Dear Premier Kenney, Minister Copping, and Minister LaGrange,

As the AMA Section of Pediatrics, we are very disappointed and concerned about your government's plan to lift public health protections. This announcement comes while our health system remains under significant strain due to staff shortages, test positivity rates are still in the 30% range and there continues to be unsustainably high rates of daily hospitalizations, ICU admission and deaths due to COVID. Lifting these protections now will only increase the strain on our already strained health care system. Meanwhile, the re-allocation of resources to meet the "surge" demand of COVID hospitalizations has come and will continue to come at the cost of health care services for other patients, including children.

Although COVID is often milder in children, it is not harmless. We have seen increased hospitalizations in extremely young children with COVID and Multisystem Inflammatory Syndrome in Children (MIS-C) in older children. We have watched pediatric ICU beds be used for adult ICU patients. We have seen youth suffering prolonged symptoms after mild COVID infections. We have seen therapies for children with disabilities cancelled due to redeployment of staff to support the surge of COVID patients. We have supported children experiencing mental health and developmental issues exacerbated by the unmitigated spread of COVID causing school and activity disruptions. We have been left wondering what resources will be left for children with complex developmental, medical and mental health conditions and what impact the lack of access to these supports will be on their lives and their families. There have been significant negative impacts on children and their families, not only from the public health measures themselves, but also from having put these measures in place because of uncontrolled spread of COVID due to premature removal of public health protections by your government.

We have watched for two years as the health of children has been put behind the health of adults with COVID. The cost of this is reaching a point of crisis and will not improve if COVID cases continue to rise. Your government's plans for removal of public health measures have come without the necessary commitment to investing in protecting our children and communities. We need your government to prioritize the community accessibility of COVID vaccination for all eligible children along with concomitant education and awareness campaigns. This could happen through school vaccination sites, public-transit accessible vaccine sites and community outreach programs. We need a strong and clear message from your government that acknowledges the evidence that COVID vaccines are safe and one of the best ways to protect our children backed by equally strong measures to improve accessibility to pediatric COVID vaccinations.
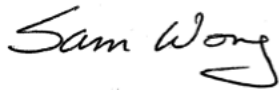
/2

We know that masks reduce transmission of respiratory infections including COVID and the large majority of children do not mind wearing masks. There is currently no evidence that masking in school situations negatively impacts children's mental health or development.

Until we are at a point where larger numbers of children are vaccinated and case rates are consistently low, it is vitally important that we keep in place the protections that have led to Canada having one of the lowest death rates per capita among the developed countries of the world. This means continuance of masking in indoor spaces including schools, optimizing ventilation, isolating when symptomatic or COVID positive, using rapid tests appropriately, and getting booster doses of the COVID vaccine when eligible.

Without adequate control of COVID infection rates, families risk daycare shut-downs, school closures and activity cancellations due to outbreaks and health resources will continue to be redirected from children to treat hospitalized COVID patients. Rampant COVID transmission in the community is a major factor in families' decisions to keep their children home to avoid exposures that may occur via activities and socialization. The long-term health and development of Alberta's children is dependent on consistent and adequate mitigation of COVID. It is time for our province to truly start putting children first.

Yours sincerely,

Sam Wong
President, AMA Section of Pediatrics

cc: Rachel Notley
        Leader of the Opposition

        David Shepherd
        MLA for Edmonton-City Centre
        Health Critic

        Sarah Hoffman
        MLA for Edmonton-Glenora
        Opposition Deputy Leader
        Education Critic

        Dr. Vesta Michelle Warren
        President, AMA

        Mike Gormley
        Executive Director, AMA

From:	21(1)
To:	COVID-19 Public Enquiries / Demandes publiques COVID-19 (DH/MS)
Subject:	Mask mandates
Date:	March 30, 2022 5:12:00 PM

I'm writing to express my concerns and the concerns of many parents and teachers about the rumors of re masking children in school. If safety and well being of our children is your main concern you'd leave them to choose whether to mask up or not, I can not tell you what a difference lifting the mandates have made on the kids in the classroom, they concentrate 100 percent better, they smile more, and I've had many kids say they feel like there's hope now to have a normal life in the future, they're thriving now, they're noticeably less depressed. Please, I encourage you to leave this decision up to parents.

From:	Russell, Dr. Jennifer (DH/MS)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	Fwd: - Best Advice
Date:	April 1, 2022 2:40:48 PM

Get Outlook for iOS

From: 21(1)
Sent: Friday, April 1, 2022 2:24:59 PM
To: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>
Subject: Fwd: - Best Advice

ATTENTION! External email / courriel externe.

Does Public Health NB agree with this information from Dr. Henry and if so
should it not be front page information for all New Brunswickers as I think from talking to and meeting
people that many are confused, eg. people walking alone,outdoors, and wearing a mask,
putting masks on little children.

---------- Forwarded message ---------
From: 21(1)
Date: Fri, Dec 31, 2021 at 9:53 AM
Subject: Fwd: - Best Advice
To: 21(1)

Do you think Dr. Russell would have this published in NB newspapers?
Your article on Omigron was very informative .
21(1)

---------- Forwarded message ---------
From: 21(1)
Date: Thu, Dec 30, 2021 at 12:26 PM
Subject: - Best Advice
To:

Subject: - Best Advice

A voice of reason. . . . Healthy, happy

and safe.

Dr. Henry is the Provincial Health Officer for British Columbia,

the first woman in this position.

She is also an associate professor at the University of British Columbia.

She has a background in epidemiology

and is a specialist in public health and preventive medicine.

She is also from PEI.

The Wisdom of Dr. Bonnie Henry

1. We may have to live with COVID-19 for months or years. Let's not deny it or panic.

Let's not make our lives useless. Let's learn to live with this fact.

2. You can't destroy COVID-19 viruses that have penetrated cell walls,

by drinking gallons of hot water you'll just go to the bathroom more often.

3. Washing hands and maintaining a two-meter physical distance

is the best method for your protection.

4. If you don't have a COVID-19 patient at home,

there's no need to disinfect the surfaces at your house.

5. Packaged cargo, gas pumps, shopping carts and ATMs do not cause infection.

If you wash your hands, live your life as usual.

6. COVID-19 is not a food infection. It is associated with drops of infection like the 'flu.

There is no demonstrated risk that COVID-19 is transmitted by food.

7. You can lose your sense of smell with a lot of allergies and viral infections

This is only a non-specific symptom of COVID-19.

8. Once at home, you don't need to change your clothes urgently and go shower!

Purity is a virtue, paranoia is not!

9. The COVID-19 virus doesn't hang in the

air for long.

This is a respiratory droplet infection that requires close contact.

10. The air is clean, you can walk through the gardens and through parks

(just keeping your physical protection distance).

11. It is sufficient to use normal soap against COVID-19, not antibacterial soap

This is a virus, not a bacteria.

12. You don't have to worry about your food orders.

But you can heat it all up in the microwave, if you wish.

13. The chances of bringing COVID-19 home with your shoes is like being struck

by lightning twice in a day. I've been working against viruses

for 20 years — drop infections don't spread like that!

14. You can't be protected from the virus by taking vinegar,

sugarcane juice and ginger! These are for immunity not a cure.

15. Wearing a mask for long periods interferes with your breathing

and oxygen levels. Wear it only in crowds.

16. Wearing gloves is also a bad idea; the virus can accumulate into the glove

and be easily transmitted if you touch your face.

Better just to wash your hands regularly.

Immunity is greatly weakened by always staying in a sterile environment.

Even if you eat immune boosting foods,

please go out of your house regularly to any park/beach.

Immunity is increased by EXPOSURE TO PATHOGENS,

not by sitting at home and consuming fried/spicy/sugary food and aerated drinks

Be smart and stay informed! Live life sensibly and to the fullest.

Be Kind, Be Calm and Be Safe!

Sincerely, Dr. Bonnie Henry

This am if we could have these points.

Jennifer

From: Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Sent: Tuesday, April 5, 2022 9:23 AM
To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>; NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>
Cc: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>
Subject: FW: Masks psychosocial

Hi Jennifer,

Key points re: Mental Health. Danielle and Joyce and Lori may have a few points to add but I wasn't sure on the timeline this was needed.

Annie

From: Hoyt, Dr. Linda (DH/MS) <Linda.Hoyt@gnb.ca>
Sent: April 5, 2022 9:17 AM
To: Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Subject: RE: Masks psychosocial

I think the public health Ontario resource is good (Mask-wearing in Children and COVID-19…What We Know So Far (publichealthontario.ca)). It's recent and credible. Their key finding:

"There was no objective evidence for reduced respiratory function in children that wore masks, with commonly reported complaints being subjective. There was no evidence of negative cognitive impacts and there were mixed results for studies on the psychological, communicative and dermatologic impacts of child mask-wearing."

So……here's some potential wording:

- 26(1)(a) ██
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  ████████████████████████████████

- ██
  ██

Linda

Linda Hoyt, MD, FRCPC, CCPE

Medical Officer/Medecin Administratrice
Addictions and Mental Health Services/ Services de traitement des dépendances et de la santé mentale
Health Services Division/ Secteur des services de santé
Department of Health/Ministère de la Santé
Government of New Brunswick/Gouvernement du Nouveau-Brunswick

E-mail / Courriel : Linda.Hoyt@gnb.ca
www.gnb.ca

Improving the lives of New Brunswickers every day. /
Améliorer la vie des Néo-Brunswickois au quotidien.

From: Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Sent: April 5, 2022 8:15 AM
To: Hoyt, Dr. Linda (DH/MS) <Linda.Hoyt@gnb.ca>
Subject: FW: Masks psychosocial

From: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>
Sent: April 5, 2022 8:13 AM
To: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>; Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Subject: FW: Masks psychosocial

Dr. Russell,
Joyce did some digging yesterday and has provided the below. Annie may have further information to share.

Lori

Research tends to be centered on short term impact of wearing masks to prevent transmission. Difficult to determine the long term impact of mask wearing after only 2 years. In addition, with so many variables changed in society by using a multi-layer protective approach, difficult to pinpoint impact on just one mitigation strategy.

1. There was no evidence of negative cognitive impacts and there were mixed results for studies on the psychological, communicative and dermatologic impacts of child mask-wearing. https://www.publichealthontario.ca/-/media/documents/ncov/covid-wwksf/2021/08/wwksf-wearing-masks-children.pdf?sc_lang=en
2. Rapid Evidence Review: Pediatric mask wearing associated with lower attack rate. No mention of mental health impact. https://covid19evidencereviews.saskhealthauthority.ca/en/permalink/coviddoc379
3. Mental health of pediatrics is impacted; however does not identify mask wearing as sole cause. https://covid19evidencereviews.saskhealthauthority.ca/en/permalink/coviddoc325
4. EBDM for mask use. No mention pediatrics. https://www.mcmasterforum.org/networks/covid-end/resources-to-support-decision-makers/inventory-of-evidence-syntheses/public-health-measures

26(1)(a)

From: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>
Sent: Monday, April 4, 2022 4:28 PM
To: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>
Subject: Fwd: Masks psychosocial

Get

From: Russell, Dr. Jennifer (DH/MS)
Sent: Monday, April 4, 2022 1:26:17 PM
To: Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Cc: Leger, Dr. Yves (DH/MS) <Yves.Leger@gnb.ca>; Macfarlane, Bruce (DH/MS)
<Bruce.Macfarlane@gnb.ca>; Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Elliott, Jennifer (DH/MS)
<Jennifer.Elliott@gnb.ca>
Subject: Masks psychosocial

Hi Annie,
Would you happen to have data or messaging around the negative impacts of mask wearing in kids
and youth.

fyi

Jennifer

From: Mason, Julie (EECD/EDPE) <Julie.Mason@gnb.ca>
Sent: Tuesday, April 5, 2022 9:11 AM
To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>; Caldwell, Craig (EECD/EDPE) <Craig.Caldwell@gnb.ca>
Cc: Lacenaire, Lisa (EECD/EDPE) <Lisa.Lacenaire@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>
Subject: RE: URGENT- Student benefits and risks

Thank you for this, Jennifer. I had a couple of questions to Mathieu yesterday, much in line with this direction and trying to better understand the impacts of current COVID variants on the health of children (knowing they are seldom hospitalized, but what other measures of severity do we have).

From an evidence of impact on learning, it is still early, and it will be near impossible to tease out the evidence from COVID in general (including physical distancing, less human interactions, less activities such as clubs and families getting together, etc.) and mask wearing specifically. Trends we are seeing :

- Mental health : depression and anxiety in particular at all age levels, but middle school and up in particular
- Language development :
  - In the francophone sector, we are seeing a rise in the % of children aged approx. 4 years identified at risk (33.9% of children are identified at risk – North Western part of the province saw a rise of 5.4% in children at risk)
  - In the francophone sector, the ASQ assessments (ages and stages questionnaire) we have completed with willing parents of 18-24 month olds is demonstrating a higher than historical level of risk. 10% have required early childhood intervention, 17% require support from Talk with Me (speech language pathologists in Part 2 for low and medium levels of intervention – acute is via Part 3, see waitlist challenge below)
  - Waitlists for speech language pathologists are growing and extending to almost 2 years in some regions (ie: a 2 year old demonstrating severe risks to language development may only be seen at age 4!)
  - Psychologist Manon Porelle contributed in an article on early childhood : the impact of mask wearing will require an explicit teaching our children, over the next few years, in reading facial expressions in others
  - Partnerships in Autism group are also seeing additional challenges with children with an autism diagnosis in their language development, but say it is still to early to quantify
- Observations made by early childhood intervention specialists:
  - Children are more timid, more reserved

- Children are demonstrating anxiety (toxic stress)
- Children are more difficult to approach, sometimes demonstrate fear
- Children have more difficulty managing their emotions

I hope this is helpful.

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Sent: Tuesday, April 5, 2022 8:35 AM
To: Mason, Julie (EECD/EDPE) <Julie.Mason@gnb.ca>; Caldwell, Craig (EECD/EDPE) <Craig.Caldwell@gnb.ca>
Cc: Lacenaire, Lisa (EECD/EDPE) <Lisa.Lacenaire@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>
Subject: FW: URGENT- Student benefits and risks
Importance: High

Good morning Julie and Craig ,

We are looking to respond to the NBMS, and pediatricians regarding masking.

Several points are being pulled together to note:
- graphs showing that the under 20s have peaked
- mental health impacts
- **the evidence on impacts on learning (if you could please share this with us)**

We are seeing majority of province with the exception of a few voices south of the province still in favor of no masks.

26(1)(a)

If we could get these bullets this am that would be appreciated.

Thanks and happy to discuss if needed.

Jennifer

From:	NBPH_CRT (DH/MS)
To:	Clair, Suzanne (DH/MS)
Subject:	FW: Student benefits and risks
Date:	April 5, 2022 10:11:08 AM
Attachments:	2022-04-05Mask Wearing and MH.docx
Importance:	High

Hi,
Can you review for approval. Jennifer would like these this morning.
Lori

https://hsps.gnb.ca/sites/phs/cds/rd/NCOV2019/DOCUMENTS/1.%20DEVELOPMENT_APPROVAL/20
22-04-05Mask%20Wearing%20and%20MH.docx

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Sent: Monday, April 4, 2022 5:19 PM
To: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>; Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Cc: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>; Donovan, Wendy (DH/MS)
<Wendy.Donovan@gnb.ca>
Subject: FW: Student benefits and risks
Importance: High

Need some points for Media tomorrow regarding masking….

Aside from the lower risks seen in children with COVID, need two leads, one from PH and one from
Mental Health and Addictions for pulling the evidence quickly together on positive impacts for
second language training, social impacts, and psychological wellness with masks being encouraged
but not mandatory and everyone having a choice.

Want to make sure we have some folks on this?
Anticipate needing this information to respond to media tomorrow.

Thanks,

26(1)(a)

From:	Clair, Suzanne (DH/MS)
To:	NBPH_CRT (DH/MS)
Subject:	RE: Student benefits and risks
Date:	April 5, 2022 11:49:36 AM

Ok… 26(1)(a) ████████████████████████████████████

Or is the yellow what you are proposing?? Made some edits

From: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>
Sent: April-05-22 11:40 AM
To: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>
Subject: RE: Student benefits and risks

Suzanne,
I have one more sentence to add to the mask messaging based on the paragraph below supplied to Jennifer from EECD this morning:
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Lori

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From: NBPH_CRT (DH/MS)
Sent: Tuesday, April 5, 2022 11:32 AM
To: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>
Subject: RE: Student benefits and risks

There was another email from Jennifer with info she got from EECD re masks – I am extracting a line or two from that to add – will send to you.
Lori

From: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>
Sent: Tuesday, April 5, 2022 11:31 AM
To: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>
Subject: RE: Student benefits and risks

Thanks…looks good. I accepted the track changes.

From: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>
Sent: April-05-22 11:25 AM
To: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>
Subject: RE: Student benefits and risks

Made further changes. Let me know if good to send to Jennifer.
Lori

https://hsps.gnb.ca/sites/phs/cds/rd/NCOV2019/DOCUMENTS/1.%20DEVELOPMENT_APPROVAL/2022-04-05Mask%20Wearing%20and%20MH.docx

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From: NBPH_CRT (DH/MS)
Sent: Tuesday, April 5, 2022 10:10 AM
To: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>
Subject: FW: Student benefits and risks
Importance: High

Hi,
Can you review for approval. Jennifer would like these this morning.
Lori

https://hsps.gnb.ca/sites/phs/cds/rd/NCOV2019/DOCUMENTS/1.%20DEVELOPMENT_APPROVAL/2022-04-05Mask%20Wearing%20and%20MH.docx

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From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Sent: Monday, April 4, 2022 5:19 PM
To: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>; Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Cc: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>; Donovan, Wendy (DH/MS) <Wendy.Donovan@gnb.ca>
Subject: FW: Student benefits and risks
Importance: High

Need some points for Media tomorrow regarding masking….

Aside from the lower risks seen in children with COVID, need two leads, one from PH and one from Mental Health and Addictions for pulling the evidence quickly together on positive impacts for second language training, social impacts, and psychological wellness with masks being encouraged but not mandatory and everyone having a choice.

Want to make sure we have some folks on this?
Anticipate needing this information to respond to media tomorrow.

Thanks,

From:	NBPH_CRT (DH/MS)
To:	Elliott, Jennifer (DH/MS)
Cc:	Clair, Suzanne (DH/MS); Donovan, Wendy (DH/MS); Pellerin, Annie (DH/MS)
Subject:	RE: Student benefits and risks
Date:	April 5, 2022 11:54:59 AM
Attachments:	2022-04-05Mask Wearing and MH.docx

Hello Jennifer,

Please find attached massaging regarding masking and children.

Lori

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Sent: Monday, April 4, 2022 5:19 PM

To: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>; Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>

Cc: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>; Donovan, Wendy (DH/MS) <Wendy.Donovan@gnb.ca>

Subject: FW: Student benefits and risks

Importance: High

Need some points for Media tomorrow regarding masking….

Aside from the lower risks seen in children with COVID, need two leads, one from PH and one from Mental Health and Addictions for pulling the evidence quickly together on positive impacts for second language training, social impacts, and psychological wellness with masks being encouraged but not mandatory and everyone having a choice.

Want to make sure we have some folks on this?

Anticipate needing this information to respond to media tomorrow.

Thanks,

26(1)(a)

From:	Day, Barbara (DH/MS)
To:	NBPH_CRT (DH/MS); Mullin, Tanya (DH/MS)
Subject:	RE: Student benefits and risks
Date:	April 5, 2022 1:38:00 PM

Thank you Lori - will pull from these messages for media on masking.

From: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>
Sent: April 5, 2022 11:58 AM
To: Day, Barbara (DH/MS) <Barbara.Day@gnb.ca>; Mullin, Tanya (DH/MS) <Tanya.Mullin@gnb.ca>
Subject: FW: Student benefits and risks

Mask messaging attached and in final folder. Approved by Suzanne. Not sure if Jennifer will have feedback but will let you know if anything needs to be changed for messaging.
Lori

https://hsps.gnb.ca/sites/phs/cds/rd/NCOV2019/DOCUMENTS/3.%20FINAL/2022-04-05Mask%20Wearing%20and%20MH.docx

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From: NBPH_CRT (DH/MS)
Sent: Tuesday, April 5, 2022 11:54 AM
To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Cc: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>; Donovan, Wendy (DH/MS) <Wendy.Donovan@gnb.ca>; Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Subject: RE: Student benefits and risks

Hello Jennifer,
Please find attached massaging regarding masking and children.

Lori

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Sent: Monday, April 4, 2022 5:19 PM
To: NBPH_CRT (DH/MS) <NBPH_CRT@gnb.ca>; Pellerin, Annie (DH/MS) <Annie.Pellerin@gnb.ca>
Cc: Clair, Suzanne (DH/MS) <suzanne.clair@gnb.ca>; Donovan, Wendy (DH/MS) <Wendy.Donovan@gnb.ca>
Subject: FW: Student benefits and risks
Importance: High

Need some points for Media tomorrow regarding masking….

Aside from the lower risks seen in children with COVID, need two leads, one from PH and one from Mental Health and Addictions for pulling the evidence quickly together on positive impacts for second language training, social impacts, and psychological wellness with masks being encouraged

but not mandatory and everyone having a choice.

Want to make sure we have some folks on this?
Anticipate needing this information to respond to media tomorrow.

Thanks,

From:	Caldwell, Craig (EECD/EDPE)
To:	Elliott, Jennifer (DH/MS); Mason, Julie (EECD/EDPE)
Cc:	Lacenaire, Lisa (EECD/EDPE); Macfarlane, Bruce (DH/MS); Chalifoux, Mathieu (DH/MS)
Subject:	RE: URGENT- Student benefits and risks
Date:	April 5, 2022 2:06:32 PM
Attachments:	Effect_Masks_Interpersonal_Communication_2020.pdf
	Masked_Education_Benefist_Burdens_2020.pdf
	Masks_Affect_Emotion_Recognition_2021.pdf

Here are some articles that might provide some additional thoughts.

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Sent: April 5, 2022 9:37 AM
To: Mason, Julie (EECD/EDPE) <Julie.Mason@gnb.ca>; Caldwell, Craig (EECD/EDPE) <Craig.Caldwell@gnb.ca>
Cc: Lacenaire, Lisa (EECD/EDPE) <Lisa.Lacenaire@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>
Subject: RE: URGENT- Student benefits and risks
Are you able to provide the research that these points were determined from regarding the impact on children and leaning. It would also be good to have some for the general population and we can then show the increase risk for those more vulnerable.
Thanks,
Jennifer

From: Mason, Julie (EECD/EDPE) <Julie.Mason@gnb.ca>
Sent: Tuesday, April 5, 2022 9:11 AM
To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>; Caldwell, Craig (EECD/EDPE) <Craig.Caldwell@gnb.ca>
Cc: Lacenaire, Lisa (EECD/EDPE) <Lisa.Lacenaire@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>
Subject: RE: URGENT- Student benefits and risks
Thank you for this, Jennifer. I had a couple of questions to Mathieu yesterday, much in line with this direction and trying to better understand the impacts of current COVID variants on the health of children (knowing they are seldom hospitalized, but what other measures of severity do we have). From an evidence of impact on learning, it is still early, and it will be near impossible to tease out the evidence from COVID in general (including physical distancing, less human interactions, less activities such as clubs and families getting together, etc.) and mask wearing specifically. Trends we are seeing :

- Mental health : depression and anxiety in particular at all age levels, but middle school and up in particular
- Language development :
  - In the francophone sector, we are seeing a rise in the % of children aged approx. 4 years identified at risk (33.9% of children are identified at risk – North Western part of the province saw a rise of 5.4% in children at risk)
  - In the francophone sector, the ASQ assessments (ages and stages questionnaire) we have completed with willing parents of 18-24 month olds is demonstrating a higher than historical level of risk. 10% have required early childhood intervention, 17% require support from Talk with Me (speech language pathologists in Part 2 for low and medium levels of intervention – acute is via Part 3, see waitlist challenge below)

- Waitlists for speech language pathologists are growing and extending to almost 2 years in some regions (ie: a 2 year old demonstrating severe risks to language development may only be seen at age 4!)
- Psychologist Manon Porelle contributed in an article on early childhood : the impact of mask wearing will require an explicit teaching our children, over the next few years, in reading facial expressions in others
- Partnerships in Autism group are also seeing additional challenges with children with an autism diagnosis in their language development, but say it is still to early to quantify
  - Observations made by early childhood intervention specialists:
    - Children are more timid, more reserved
    - Children are demonstrating anxiety (toxic stress)
    - Children are more difficult to approach, sometimes demonstrate fear
    - Children have more difficulty managing their emotions

I hope this is helpful.

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Sent: Tuesday, April 5, 2022 8:35 AM
To: Mason, Julie (EECD/EDPE) <Julie.Mason@gnb.ca>; Caldwell, Craig (EECD/EDPE) <Craig.Caldwell@gnb.ca>
Cc: Lacenaire, Lisa (EECD/EDPE) <Lisa.Lacenaire@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>
Subject: FW: URGENT- Student benefits and risks
Importance: High

Good morning Julie and Craig ,

We are looking to respond to the NBMS, and pediatricians regarding masking.

26(1)(a)

If we could get these bullets this am that would be appreciated.

Thanks and happy to discuss if needed.

Jennifer

Check for updates

Effect of Face Masks on Interpersonal Communication During the COVID-19 Pandemic

Nour Mheidly[1], Mohamad Y. Fares[2,3,4], Hussein Zalzale[2] and Jawad Fares[5]*

[1] Department of Communication and Journalism, Autonomous University of Barcelona, Barcelona, Spain, [2] Faculty of Medicine, American University of Beirut, Beirut, Lebanon, [3] College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, United Kingdom, [4] Faculty of Medical Sciences, Neuroscience Research Center, Lebanese University, Beirut, Lebanon, [5] Department of Neurological Surgery, Feinberg School of Medicine, Northwestern University, Chicago, IL, United States

Interpersonal communication has been severely affected during the COVID-19 pandemic. Protective measures, such as social distancing and face masks, are essential to mitigate efforts against the virus, but pose challenges on daily face-to-face communication. Face masks, particularly, muffle sounds and cover facial expressions that ease comprehension during live communication. Here, we explore the role of facial expressions in communication and we highlight how the face mask can hinder interpersonal connection. In addition, we offer coping strategies and skills that can ease communication with face masks as we navigate the current and any future pandemic.

Keywords: SARS-CoV-2, coronavirus, communication, social distancing, pandemic (COVID-19), pandemic

INTRODUCTION

The COVID-19 pandemic has severely affected the way people communicate with each other. Precautionary measures to limit the spread of the virus necessitated a shift in the communication paradigm when it comes to greetings and handshakes. The arising situation required people to adopt salutations that do not entail physical contact, such as the "peace sign," the "hand on chest," and the "namaste" (1). In addition, emphasis on personal spaces and social distancing markedly increased, with telecommunication witnessing a huge rise, as business meetings, conferences, and educational activities shifted to virtual communication via social applications, such as Zoom, Cisco Webex, Skype, and Microsoft Teams.

Face-to-face communication, specifically, was majorly affected by the pandemic. The need for face masks, as an important protective measure to decrease the spread of the virus, had a huge toll on interpersonal communication. Facial expressions and gestures play a major role in facilitating interpersonal communication, comprehension, and the delivery of intended messages. As such, wearing face masks hindered the ability of seeing and understanding people's expressions during conversations, and decreased the impact of communicated material.

In this piece, we explore the role of facial expressions in communication and we highlight how the face mask can affect it. In addition, we offer coping strategies to enhance the quality of interpersonal communication while wearing protective face masks.

ROLE OF FACIAL EXPRESSIONS IN COMMUNICATION

Facial expressions play a prominent role in communication and relay of emotion across individuals. People perceive facial expressions off one another, and this helps them forecast events and

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situations, and develop responses to them (2). The face, as an anatomical figure, can be separated into upper, middle, and lower portions, with each playing an important role in expressing the feelings and moods of an individual (3). For example, actions like smiling and grimacing involve lower facial structures, like the mouth, the lips, and the cheeks, and these are often included in our daily conversations.

Facial expressions of different emotions involve action units, or elementary changes in facial appearance recognized by the Facial Action Coding System, which is a system that taxonomizes human facial movements by their appearance on the face. These facial expressions are produced by a set of facial muscles (4). The middle face involves the "nose wrinkle," an action unit that wrinkles and pulls the skin upward along the sides of the nose; this is used to convey disgust (4, 5). The lower face involves multiple action units, and these include the "chin raiser," the "lip stretcher," the "lip tightener," the "lips part," and the "jaw drop," and each is associated with a set of facial muscles that convey a specific emotion (4, 5). The "chin raiser" pushes the boss of the chin and the lower lip upward, while the "lip tightener" causes lips to appear narrower; both action units are used to convey anger (4, 5). The "lips stretcher" stretches lips horizontally, and the "lips part" separates them to a limited extent; both action units are used to convey fear (4, 5). In addition, the "jaw drop" parts lips so that the space between the teeth is visible and this is used to convey surprise (4, 5).

The middle and lower face are noted to be very influential with regards to emotional recognition. Kestenbaum explored the modes of processing of emotional expression in children and showed that the mouth can be used to recognize a neutral expression and is best for recognizing the emotion of happiness (6). Gagnon et al. investigated children's ability to recognize fear, surprise, disgust, and anger based on information from the upper, middle, or lower face, and found that children can recognize fear, surprise, and anger using expressions involving the lower face, and disgust using expressions involving the middle face (5). While the upper face is also pivotal for the development of emotional expressions, the roles of the middle and lower face cannot be understated.

MASKING FACIAL COMMUNICATION

The high infectivity of SARS-CoV-2 and the increasing rates of COVID-19 infection pushed physicians and health experts to recommend wearing facemasks during the pandemic. This measure combined with social distancing and handwashing helps in slowing the spread of the virus and decreasing its transmission, especially between people that are designated as asymptomatic carriers (7, 8). Previous studies comparing non-fit-tested P2 masks, surgical masks, and no masks in fighting influenza for households had shown that masks may reduce the transmission of viruses during pandemics (9).

Despite its crucial protective role, the face mask poses challenges on daily face-to-face communications. Interpersonal communication describes the interaction between two

individuals or more through oral or physical (gestures) interactions. Proper application of the protective mask involves covering the mouth and the nose, which muffles sound and makes it challenging to understand speech and some higher-pitched voices. Furthermore, face masks eliminate the roles of the middle and lower face in emotional expression, rendering its action units invisible to the receiving individual (**Figure 1**). For example, in the physician-patient setting, positive facial expressions play an important role in decreasing the patient's anxiety (10). Therefore, the physician-patient relationship is affected by wearing face masks. Covering the face will reduce the ability of determining the patient's feelings and emotions and affect the physician's measured response to the situation (10). Likewise, the physician's expression of empathy can be missed by the patient. Furthermore, people with special needs and hearing disabilities rely on sign language to communicate. Covering the lower part of the face (nose, cheeks, mouth, tooth, nose, and chin) will adversely affect their understanding of communicated information and make them feel more disabled and ostracized. As a result, emotional perception decreases and the role of the upper face in emotional expression increases in significance.

Nonverbal communication, such as facial gestures and expressions, constitutes 55% of our overall communication (11). The eyes and the mouth are the two main organs that help in reading other's faces. By wearing face masks, people are inclined to focus more on the eyes to be able to understand the facial expressions intended. Eye contact can be used to show empathy and concern for others, to manage feelings, to express interest, or to help with communication. Nevertheless, prolonged eye contact can result in uncomfortable feelings sometimes (11), as it can magnify actual interest in communicated material or convey signs of aggression.

There are a number of populations globally that veil the face for religious or cultural reasons (12). In addition, surgical or cloth face masks have been worn in several East Asian countries since the early 20th century (13). During the 1918 flu pandemic, face masks were commonly worn around the globe (14). After Japan's Great Kanto Earthquake of 1923, firestorms and thick smoke and ash in the air also necessitated face masks. Singapore and Hong Kong suffered flu pandemics in the 1950s and 1960s, and the SARS outbreak of the early 2000s was particularly troublesome for China, Hong Kong, and Taiwan (15). Wearing a face mask became a cultural sign of respect and a social contract toward others. Nevertheless, in the West, the subtraction of nose, mouth, and cheeks during interpersonal communication will necessitate further adaptation.

ENHANCING COMMUNICATION WITH FACE MASKS

Given the importance of face masks in mitigating the spread of COVID-19, communication adjustments are needed to adapt to the new "normal." Here, we highlight coping measures that can enhance the quality of interpersonal communication while wearing a face mask:
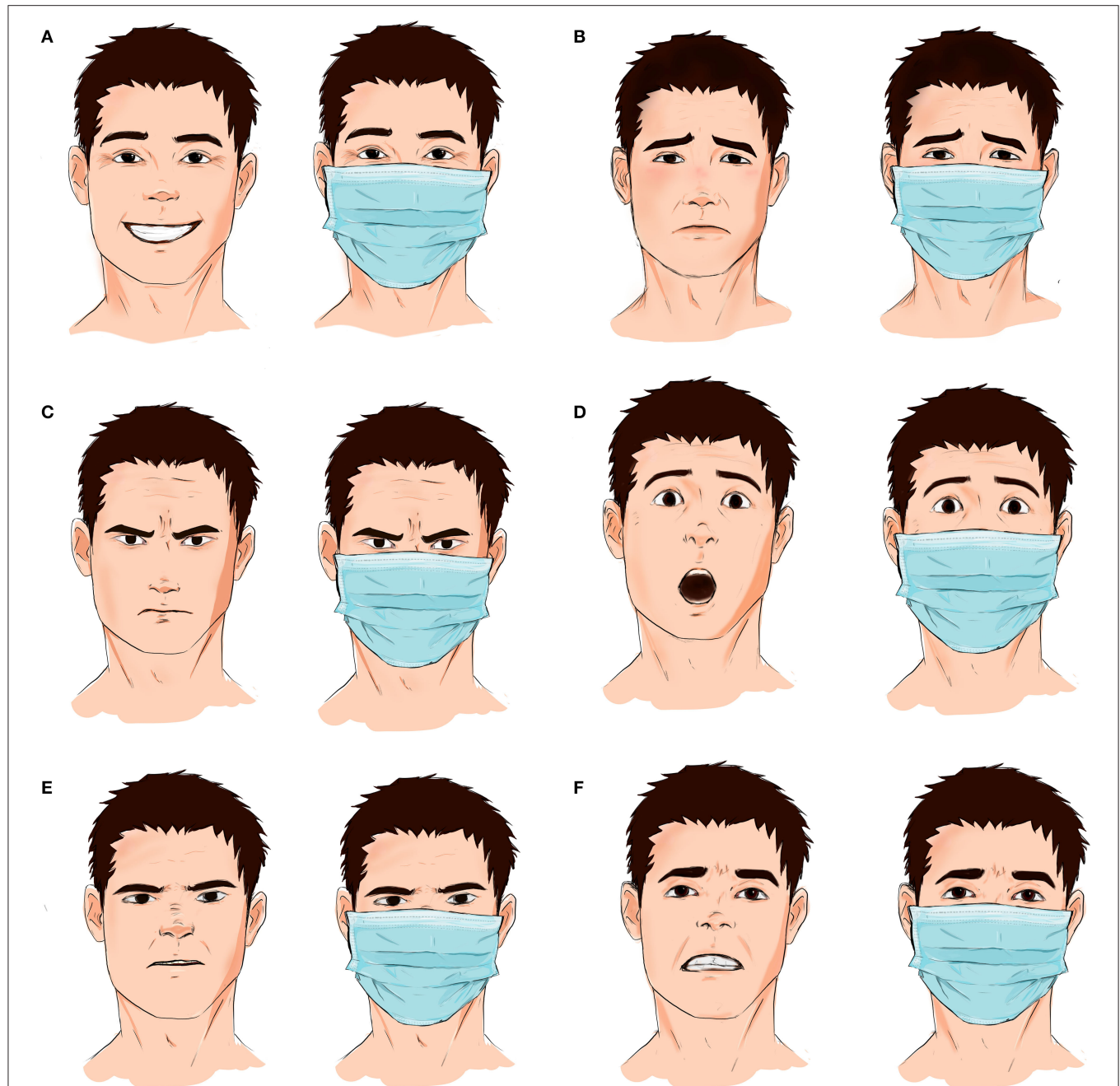
FIGURE 1 | Face masks cover the middle and the lower portions of the face. As such, facial expressions involving the mouth, lips, teeth, and nose are masked during interpersonal communication. **(A)** Happiness is usually perceived when the corners of the lips rise upward. With face masks, happiness can be caught on the face by focusing on the wrinkles at the edge of the eyes. **(B)** Sadness involves movement of the eyebrows, the nasolabial folds, and the corners of the lips; however, the last two are masked by face masks. **(C)** Facial expression of anger emphasizes the downward and central movement of eyebrows, the glaring eyes, and narrowing of the corners of the lips, with the latter getting covered by face masks. **(D)** Expressions of surprise and shock are usually formed of elevated eyebrows and a raised upper lip; only the latter is covered by protective masks. **(E)** Nose wrinkling and raising of the upper lip convey feelings of disgust; however, face masks cover both expressions. **(F)** Feelings of guilt are usually portrayed by slightly upping eyebrows together and stretching the mouth, with the latter getting covered with a face mask.

1. **Raising awareness on the use of face masks and acknowledging the communication challenges that arise as a result in an objective manner**.

It is important for experts to address the underlying problems and concerns regarding face masks while highlighting their importance as protective equipment
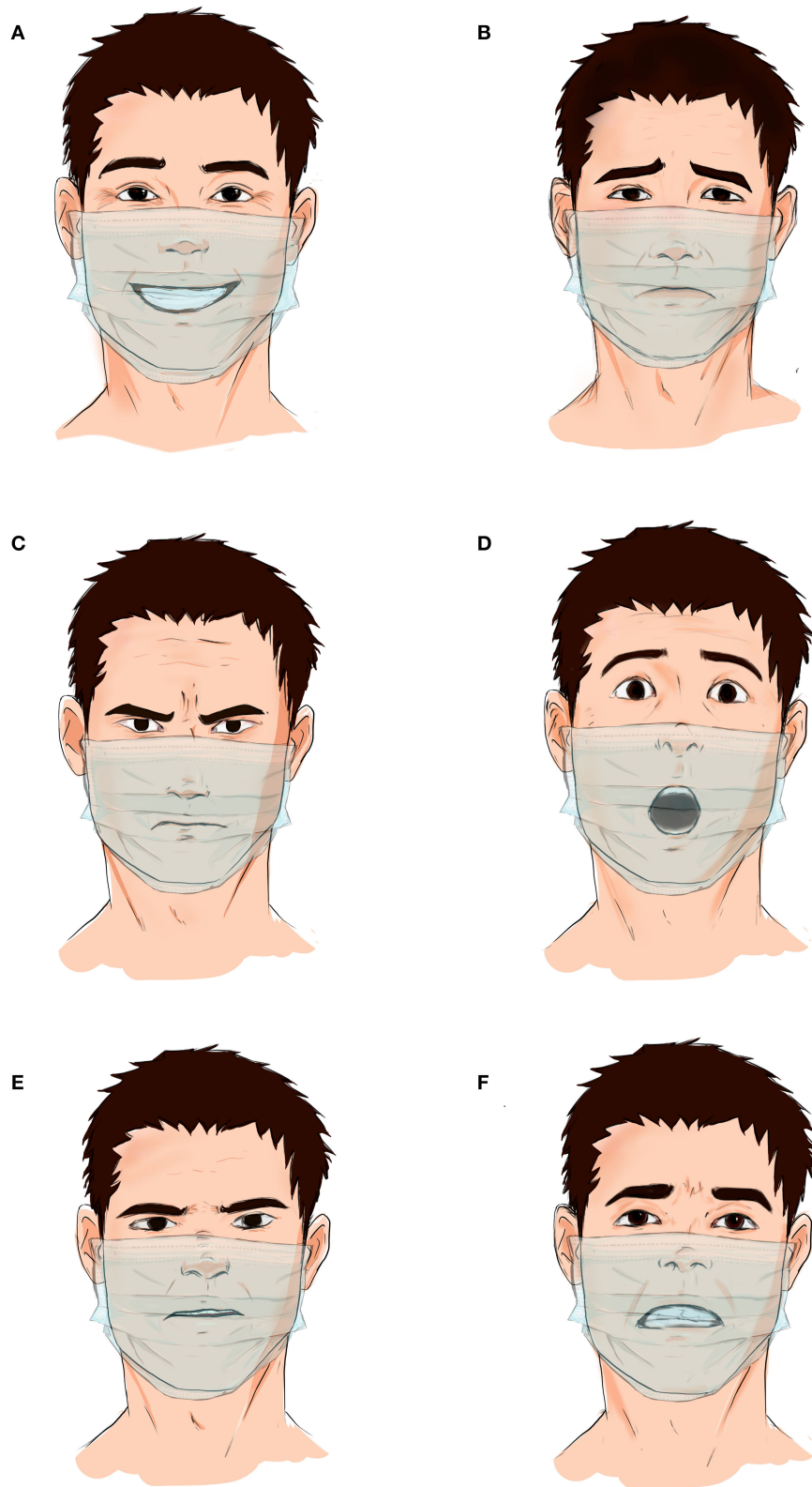
FIGURE 2 | Transparent protective face masks and face shield preserve the importance of facial expressions during interpersonal communication. Feelings of happiness **(A)**, sadness **(B)**, anger **(C)**, surprise **(D)**, disgust **(E)**, and fear **(F)** can easily be noted and picked up through the individual's facial reactions and expressions.

against infection (16). This will ease people's acceptance of and commitment to the face mask. Scientists and experts can prevent the spread of false assumptions and empower people by raising awareness on several health challenges and topics through social media, interviews, and podcasts (16).

2. **Utilizing and recognizing the upper face through the eyebrows, eyes, and upper cheeks during interpersonal communication**.

For example, closing the eyes when agreeing and raising eyebrows when opposing can be adopted in interpersonal settings. The eyebrows, specifically, have received little attention in communication research. Past work has examined the role of eyebrows in emotional expression, nonverbal communication, facial aesthetics, and sexual dimorphism (17–19). For face recognition, the eyebrows may be at least as influential as the eyes. The absence of eyebrows in familiar faces leads to a significant disruption in recognition performance (20). In fact, a significantly greater decrement in face recognition is observed in the absence of eyebrows than in the absence of eyes (20).

3. **Emphasizing the importance of non-verbal communication, such as body language, during communication**.

For example, people can express their ideas using hand gestures to facilitate the communication process. Non-verbal communications are essential in facilitating the communication process, have a vast influence on the social environment, and can come in different forms, such as facial expressions, body movements, and eye messages, which can support or substitute verbal communication (21).

4. **Paying more attention during interpersonal settings and facing the communication partner directly**.

This ensures that the communicator has the receiver's attention while nothing is blocking the visual field between them. Synchronous communication is an intended and direct form of communication, which focuses on capturing attention and conveying the needed message. It has been reported that people who communicate through synchronous communication, such as phone or face-to-face communication, perceive the urgency of a situation quicker than those receiving official messages through asynchronous channels, such as text messages (22).

5. **Talking louder and slower in quieter settings**.

Articulating speech and increasing its volume in a calm setting helps communicators overcome the sound muffling that can result from the face mask. The hierarchy hypothesis asserts that when an individual initially fails to reach social goals through communication, they will continue to try to attain them, but will alter their speech rate and vocal intensity (23).

6. **Relying more on telecommunication for interpersonal interactions**.

Technological advancements can play a central role in facilitating live connections and interactions between individuals (24). Telecommunication via Skype, Zoom, Facetime, and Cisco Webex was key in keeping the educational, economic, and health sectors alive during the outbreak.

7. **Manufacturing transparent face masks or face shields**.

People will be able to see each other's facial expressions and emotions without threatening their personal protection (**Figure 2**). This will also allow people with special needs to communicate easily and understand conversations. The elderly and individuals with hearing impairment rely heavily on facial expressions for communication. Cloth and surgical facemasks hinder their ability to understand and indulge in meaningful conversations (25). The use of transparent face masks will help those individuals read lips and have proper dialogues.

8. **Conducting cross-sectional surveys exploring the effect of face masks on communication**.

This will help in measuring the impact of the pandemic and wearing face masks on interpersonal communication, quantitatively and qualitatively (26, 27). Research must take into account the cultural differences in communication and the impact of face masks on different societal groups.

CONCLUSION

For the time being, face masks are here to stay, as we continue to make efforts to stop the spread of SARS-CoV-2. Nevertheless, identifying the problems and challenges that affect healthy communication while wearing face masks is vital to adapt better to the ensued norm. In addition, developing coping strategies and skills that can ease our communication with face masks is crucial in our efforts to navigate the COVID-19 pandemic and any other pandemic that might erupt in the future.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

NM and JF conceived the study. NM, MF, and JF wrote the first draft. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

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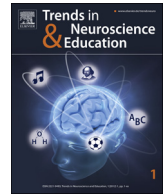
Opinion paper

Masked education? The benefits and burdens of wearing face masks in schools during the current Corona pandemic

Manfred Spitzer[1]

Department of Psychiatry, University of Ulm, Leimgrubenweg 12-14, D-89075 Ulm, Germany

ABSTRACT

Face masks can prevent the spread of the virus SARS-CoV-2, in particular as this spread can occur from people with no symptoms. However, covering the lower half of the face reduces the ability to communicate, interpret, and mimic the expressions of those with whom we interact. Positive emotions become less recognizable, and negative emotions are amplified. Emotional mimicry, contagion, and emotionality in general are reduced and (thereby) bonding between teachers and learners, group cohesion, and learning – of which emotions are a major driver. The benefits and burdens of face masks in schools should be seriously considered and made obvious and clear to teachers and students. The school's specific situation must also inform any decision regarding face mask use.

1. Introduction

A new coronavirus, SARS-CoV-2, has caused a global pandemic of the disease Covid-19, with – as of July 31st – almost 300.000 new cases within a single day, more than 17 million confirmed infections, and more than 670.000 deaths [16]. Initially regarded as some form of flu with symptoms such as fever and cough, it has been found to be much more severe, affecting not only the lungs but also the liver, heart, kidneys, and brain, with symptoms such as anosmia [12] and cognitive dysfunction due to defects of neuro-axonal integrity (even in mild to moderate cases; [1]). In severely ill patients, the virus causes a two-pronged attack by a dysfunctional immune system ("cytokine storm") and blood clotting system ("multi-organ thrombosis"; [33,66]), causing strokes with chronic neurological deficits [60,70].

Compared to adults, children are less likely to fall ill, and if so, their illness is usually mild [34]. However, in order to decrease the spread to the virus, along with other measures of physical distancing and economic lockdowns, school closures were implemented during March 2020 affecting more than 1.5 billion students (children and adolescents) around the globe [73]. These closures of schools lasted for a few weeks only (as in Denmark) up to several months (in Italy and many other countries; [15]) and led to marked decreases in educational gains [75], hunger (because school meals were no longer served), increases in child abuse (because children were no longer observed by school staff),

and, in general, the risk of "scarring the life chances of a generation of young people"[2] (because of the long-term psychological, physiological, educational and even economic burden [3], that societies put on their most vulnerable members; [15]).

As long as there is no vaccine and no specific treatment, the first pandemic of the 21st century is fought with methods from the 14th to the 19th centuries: Distancing, hand washing, and covering mouth and nose with a piece of cloth. On a global scale, face masks have become an increasingly important part of national strategies to fight the current corona pandemic. Given that school closures already have come to an end, or will have to end eventually, the question of wearing face masks at schools during the next phase of the pandemic is heavily discussed, particularly, where new cases pop up in spots of waxing and waning infections, or in some states, in the form of additional waves of infection (as for example currently in Israel, Australia and Croatia).

Because the virus is still with us, this is all the more pressing for the following characteristics of the virus and its transmission [4,8]:

- People without any symptoms may be infected and spread the SARS-CoV-2 virus.
- Upon speaking, the virus is released into the air, the louder the more.
- The virus can remain airborne for many hours in classrooms.
- Wearing masks is comparatively cheap and easy to implement and

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[1] http://www.uni-ulm.de/klinik/psychiatrie3/index.html.

[2] This quote is taken from Couzin-Frankel et al. [15], p. 241], who cite an open letter published in June 2020, signed by more than 1500 members of the United Kingdom's Royal College of Paediatrics and Child Health (RCPCH).

supervise.

- At the same time, wearing masks may have physical side effects.
- Face masks impair face recognition and face identification.
- Face masks impair verbal and non-verbal communication.
- Face masks block emotional signaling between teacher and learner.

Given these pros and cons, it is not clear whether face masks should play a major role in educational settings in times of the current viral pandemic. Moreover, given the diversity of educational settings in terms of country, culture and learners' as well as teachers' age, different considerations may weight in differently in any balanced decision as regards the use of face masks in classrooms. This matter should be discussed urgently, since it globally affects more than 1.5 billion students, teachers, and school staff directly, and, in addition, their families indirectly.

2. Face masks are effective against the spread of the new corona virus

This pandemic has been a moving target as regards our knowledge about it.[3] The issue of wearing face masks may serve as a prime example. During the time of school-closures (from about the middle of March into April and/or May 2020) it became clear that face masks covering mouth and nose in closed public spaces (public transportation, stores, restaurants etc.) are an effective means of preventing the spread of the virus and thus, the worsening of the pandemic. This had not been clear at the time when the pandemic started in most countries (February 2020), as institutions such as the World Health Organization (WHO), the US Centers of Disease Control and Prevention (CDC) and, for example, the German Robert-Koch-Institut (RKI), as well as many governments across the globe, did not recommend the use of face masks to fight Covid-19.[4]

Upon the reopening of schools in April and May, this situation had changed [2,26,45], and by June 2020 there was no longer any doubt (see Fig. 1) that wearing face masks is one of the most effective preventive measures people can take to protect themselves and others from becoming infected with the virus [65]. As mask wearing by infected individuals reduces transmission risk, and because of the high proportion of asymptomatic infected individuals [68] and transmissions, by now there is a strong case for the effectiveness of widespread use of face masks in reducing the spread of COVID-19. In short, since it is clear that people may be infected and infectious even though they do not yet show any symptoms of Covid-19 – which is a peculiar feature of the SARS-CoV-2 virus – face masks can definitely mitigate the effects of this especially dangerous virus.

In a Chinese study from Wuhan, for example, it has been estimated that up to 79% of viral infections were caused by undiagnosed, presumably asymptomatic people [47]. In two other studies, one from two surveys of 2812 and 2343 inhabitants of the small town of Vó near Padua in Italy, and another from 1032 healthcare workers (including frontline patient-facing staff such as doctors, nurses and

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[3] Historically, this was also the case one hundred years ago, after the French bacteriologist Charles Nicolle discovered that the agent that caused influenza was much smaller than any known bacterium in October 1918, i.e. at around the time of the cusp of the pandemic. This news led, even in small-town American newspapers, to statements such that using face masks against influenza is "like using barbed wire fences to shut out flies" [14]. This discouraged the wearing of masks and caused a lot of discussion and distrust in the general public.

[4] The reason for this misguiding advice became clear over time: There were too few masks. Responsible advisors wanted to make the most use what was available, and therefore gave masks and other protective equipment to hospitals, where there were in short supply and most dearly needed. They could have done better and tell people to make their own mask from cloth (and sell them, if they are good at sewing).

physiotherapists) in the UK, similar findings have been reported [42]. In the Italian study, 42,5% of confirmed SARS-CoV-2 infections were asymptomatic, and in the British study, 60% had no or only very light symptoms. That is, you get sick from contact with people who are apparently healthy. This is why in the present Covid-19 pandemic, it is not possible to have only those people wear masks who are infectious. Everybody can be infectious while not knowing it [43]. The only way to stop infections from happening, therefore, is to have *everybody* wear face masks.

It is known for more than 70 years that the act of speaking generates oral fluid droplets that vary widely in size, from clearly visible to invisibly small aerosols [24,55]. The louder someone speaks the more droplets and aerosols are produced. Regardless of their size, they all can harbor infectious virus particles and spread viral diseases [2,5,6]. In fact, the virus has been shown to remain airborne for many hours in a closed indoor space such as a classroom [49]. As Prather and coworkers note in their highly informative perspective, published in Science magazine online on May 27th 2020: "[…] calculations predict that in still air, a 100-μm droplet will settle to the ground from 8 feet in 4.6 s, whereas a 1-μm aerosol particle will take 12.4 h [to settle down]. Measurements now show that intense coughs and sneezes that propel larger droplets more than 20 feet can also create thousands of aerosols that can travel even further. […] under many indoor conditions, where aerosols can remain airborne for hours, accumulate over time, and follow airflows over distances further than 6 feet" ([65], p.6498). The authors summarize their perspective with a highly convincing drawing, which is reproduced in Fig. 1.

There is additional epidemiological evidence for the effectiveness of wearing face masks regarding the spread of the new coronavirus: In Hongkong, 96% of the populations used face mask, and the incidence of new cases in March was 129 per million inhabitants, whereas in Spain, Italy, and Germany, where at the time no face masks were used, the incidence was 2983 (Italy), 2251 (Spain), and 1242 (Germany) per million [31]. Shortly after the major of the German city of Jena (with about 110,000 inhabitants) implemented a face mask use order for the entire city on the 6th of April to fight the spread of the virus (three weeks before this was done for entire Germany), there were no new cases for 9 consecutive days. Compared with a "surrogate" Jena (a weighted mix of 4 German cities) as a control, this decline in new cases was 23% [56].

A natural experiment published on June 16th 2020 used the different timing (between April 8 and May 15) of state policies mandating public or community use of face masks or covers in 15 US states plus DC in mitigating covid-19 spread [52]. The study found that the changes in the daily county-level COVID-19 growth rates between March 31, 2020 and May 22, 2020, was associated with a decline in the daily COVID-19 growth rate by 2% by two to three weeks after the mandatory face mask use. At first blush, this may sound as a small effect, but three weeks of cumulated 2% decrease amounts to a decrease of over 40%. Accordingly, from their data, the authors estimated that as many as 230,000–450,000 Covid-19 cases had been averted by May 22, 2020.

Finally, a large comprehensive review and meta-analysis, published in the Lancet online on the 1st of June 2020, used data from 172 observational studies across 16 countries (among them 44 comparative studies in healthcare and non-healthcare settings [13]. Face masks (surgical type) reduced infection risk by 85%. Since face masks are comparatively cheap and easy to use, they are among the most simple and straight forward means to curb SARS-Cov-2 and Covid-19 transmission (see also [53]).

3. The side effects of face mask use

It is a medical truism that everything that has effects also has side effects. The physical side effects of face masks have been mostly reported by medical professionals working in surgery and related surgical environments, and science professionals working in labs. In a study of

Infected, asymptomatic

Healthy

▲ Maximum exposure

▲ Minimum exposure

Fig. 1. Face masks reduce airborne transmission of the SARS-CoV-2 virus. The authors comment: "Infectious aerosol particles can be released during breathing and speaking by asymptomatic infected individuals. No masking maximizes exposure, whereas universal masking results in the least exposure" ([65], p. 1423, © Science Magazine, with permission).

158 health care workers during the Covid-19 pandemic, the most common side effect of prolonged face mask use was bilateral headache, reported by about 80% of the participants [58]. Headaches occurred one to four times during a 30-day period of mask use and was rated as mild by the majority (72%) of respondents. Within 30 min after removal of the face mask, the pain resolved spontaneously. Pain medication (such as non-steroid analgesics) was used in only a few cases.

Face masks may further cause perioral dermatitis with rashes and redness, i.e., an infection of the skin around the mouth because of saliva, sweat, and moist vapor between the mask and the skin. This may provide a breeding ground for bacteria. Itchy rashes may be caused by irritant dermatitis, caused by the mask and/or the attached rubber strings rubbing the skin of nose and ears [63].

An experimental study on the physical effects of wearing either a surgical or an N95/FFP-2 face mask was performed with 5 healthy male and 5 healthy female subjects, who performed intermittent exercise on a treadmill while wearing the protective facemasks in a climate chamber controlled at an air temperature of 25 °C and a relative humidity of 70%. Both types of face masks led to significant differences in temperature and humidity in the microclimates between face masks and skin. In particular, compared to the surgical mask, the N95 mask led to higher humidity and skin temperatures inside the facemask, higher heart rate, and increased negative „sensations, including feeling unfit, tight, itchy, [and] fatigued," as stated by the authors ([46], p. 501). A recent study on the cardiovascular effects of face masks (surgical or N95/FFP-2) in young healthy male subjects on a bike-ergometer showed a 2 percent decrease in maximum power (not significant) for the surgical mask and a 5 percent decrease of maximal power ($p < 0,01$) for the N95/FFP-2 mask [32]. Overall, in both studies subjects preferred the surgical face mask. This finding, among others,

led to the fact that N95 masks were never recommend for wearing by the general public, as they not only are more expensive, but also – because of the discomfort they imply – much less likely to be worn by everybody for extended periods.

As regards the prevention of Covid-19, additional concerns of wearing face masks have been articulated, for example:

- Wearing a face mask may give a false sense of security and may make people less compliant with other infection control measures.
- Because of problems with understanding speech (see below), people may move closer together, without intention, and thereby increase infection risk.
- Wearing face masks may cause glasses to fog and thereby cause anything from discomfort to accidents.
- Wearing a face mask makes the exhaled air go into the eyes. "This generates an uncomfortable feeling and an impulse to touch your eyes. If your hands are contaminated, you are infecting yourself" [44].
- "Moreover, a fraction of carbon dioxide previously exhaled is inhaled at each respiratory cycle. Those phenomena increase breathing frequency and deepness, and they may worsen the burden of covid-19 if infected people wearing masks spread more contaminated air. This may also worsen the clinical condition of infected people if the enhanced breathing pushes the viral load down into their lungs," the authors add.
- When infected people re-breathe air in the mask, their virus load increases.

In other words: Whereas face masks are intended to ease the burden of the pandemic they may at the same time make it worse under certain

conditions.

In addition to these problems of physical health, three more problems of using face masks have to be addressed: Impaired face recognition and identification, impaired communication, and blocked emotional signaling.

4. Face masks impair face recognition and face identification

In daily life, human observers are extremely proficient in recognizing faces, discriminating between them and using them to derive a vast range of information, be it about static features like age, gender or identity, or changeable features like gaze direction, lip movements or emotional states (see second next section).

Human beings are biologically programmed to recognize faces [68]. As soon as babies are born, they show a preference for looking at human faces above anything else, and they will even stare at a rudimentary drawing of a face if it is shown to them. But by the age of seven months babies able to recognize angry or fearful faces [62,37]. The advantage of face-processing as compared to non-face stimuli declines during the second year of life [48].

On top of this innate preference, the role of social experience in face processing and recognition becomes ever more salient, as research with infants has shown using such different measures as behavioral data, eye-tracking data, and neuroscience data mainly from event related potentials (ERP), functional magnetic resonance imaging (fMRI), and near infrared spectroscopy (NIRS). By now, the role of experience in the process of perceptual narrowing in face processing has demonstrated enhanced behavioral and neural responsiveness to (1) mother over stranger, (2) female over male, (3) own-race over other-race, and (4) native over non-native faces. In addition, (5) infants' neural responses to faces in multimodal contexts, such as audiovisual speech, change during development, which finally leads to (6) the emergence of attentional biases that cause enhanced responsiveness and processing of faces commonly encountered in the native environment: We recognize and identify the faces of our peers faster than faces of strangers [67], just as we recognize the sounds (phonemes) of our mother tongue better than unfamiliar sounds (phonemes) from unfamiliar languages [61].

Hiding the lower part of the face with a face mask markedly impairs face recognition and face identification. In fact, this is why burglars and thieves wear them. As mask-wearing has become a normality in many societies, the magnitude with which covering our faces affects our social interactions and ability to recognize and identify other people becomes ever more clear. In school settings, the ability to know and recognize each other is normally taken for granted, and – like air for breathing – it does not come into focus unless it is lacking. But within seconds of absence, its importance is realized.

But there are also some quick fixes for this problem, such as clearly visible name tags, "personalized" masks, and our ability to recognize and identify each other from cues provided by our voice and body shape and posture.

5. Face masks impair verbal and non-verbal communication

One of the richest and most powerful tools in human communication is the face, from which observers can quickly and easily make a number of inferences — about identity, gender, sex, age, race, ethnicity, sexual orientation, physical health, attractiveness, emotional state, personality traits, pain or physical pleasure, deception, and even social status [38]. When strangers meet, who speak two different languages which they do not mutually understand, they can still interpret facial expressions such as smiles and frowns with ease and thereby communicate. In fact, the most basic form of communication between humans is by facial expressions. This is because facial expressions are a simple universal language that we instinctively understand [25]. It may be for this reason, that many people do not like the wearing masks at all in the first place.

Because we cannot see the lower half of the face when someone is wearing a mask, our ability to understand people is reduced considerably. We are forced to rely only on language and gesture, which limits the extent to which we can interpret nuance, with some input from interpreting eye movements, which are still visible above the mask. In fact, evidence from eye movement studies during gazing at a face suggests that the eye is the facial feature that is attended to first and longest during face processing, as they appear to be most informative in communication. Once we direct our gaze to something, this something thereby can become the focus of shared attention, which is a basic mechanism of doing things and solving problems *together*.

But second to the eyes are the regions of mouth and nose, when it comes to attending facial features. For effective verbal communication, covering the mouth with cloth has two detrimental consequences: First, the auditory signal is impaired, as faces masks may dampen sound amplitude, and especially may absorb frequency bands used in speech. Second, the visual signal from the lips is completely obstructed. While most people may never have realized, this signal is used by human beings to aid speech understanding. From birth to about 8 months, babies look at their mother's mouth in order to pars the stream of sound into meaningful units (phonemes) in order to learn their mother tongue. In fact, if they are reared bilingually, they have to learn a larger number of phonemes and therefore start to look at their mother's mouth earlier and for longer than monolinguals [64]. When grown up, we tend to look close at the mouth of somebody under circumstances of impaired sound comprehensibility, such as noisy environments, low quality sound in movies and video calls. Deaf people use lip-reading and thereby completely rely on visual cues for understanding speech (which is why there are special face masks with a transparent piece over the mouth to meet the demand for visual speech input).

Because speech transmission is impaired by mask-wearing, there is a risk of misunderstanding when face masks are used widely in schools. Speaking through a face mask may dampen higher frequencies and therefore may impair verbal communication. The size of the effect depends on the speaker, the type of mask, the listener's hearing, and background noise, and may therefore vary between negligible [54] and considerable [7]. In addition, it is well known that visual cues help in speech recognition, which may be an additional cause of face mask induced impairment of speech perception and communication.

6. Face masks block emotional signaling between teachers and students

Features of faces (such as the size and form of the nose, the color of the eyes etc.) and their configuration are not only used to identify faces but also to infer the emotion expressed by them [10]. Charles Darwin [18,19], the founding father of evolutionary theory, was the first to study the evolutionary origins of facial expression of emotions. Even infants below one year of age are able to comprehend facial expressions as social cues representing the feelings of other people before they are one year old. They start to respond to fearful faces but also respond to happy faces soon thereafter.

Emotions play a large role in our social interactions, of which teaching and learning are among the culturally most relevant. Recently, anthropologists have proposed, that the most recent evolution of the human brain has been shaped by its increased capacity for the cultural transmission of knowledge, i.e., teaching and learning [36].

More than 50 years ago, building upon research by European ethologists from the school of Konrad Lorenz, the Californian psychologist Paul Ekman performed experiments to demonstrate the existence of basic emotions regardless of culture: surprise, fear, disgust, anger, happiness, and sadness [27–29].

It is long known, that negative affect implies more fine-grained perceptual and cognitive processing whereas positive affect leads to more holistic processing. Accordingly, it has been shown, that emotions which are perceived in faces have an effect on the style, faces are

processed in the first place: A face that is perceived to have a negative emotion is processed in a less holistic manner than a face displaying a positive emotion [17]. Of course, this is the case for the processing of other (non-face) content: Smiling broadens cognition and thereby increases creative thinking [39], whereas criticism causes anxiety and a reduction in creativity. A student looking at the critical face of a teacher thereby becomes less creative, and thereby less able to solve math problems, which increases the likelihood of math anxiety to develop [51]. This decreases creativity further as well as increases anxiety of not being capable doing mathematics in a vicious circle – *independent of mathematical talent!*

As stated above, the face provides a universal language for communication, in particular, the communication of emotions. The mouth region on a face conveys information that is crucial for smiling, i.e., a positive emotion, which can work as social glue and facilitates positive social cognition and action [69]. Not seeing the bottom half of the face makes it particularly difficult to recognize a mask-wearer's positive emotions – pleasure, joy, happiness, amusement, sociability, and friendliness – as they are basically communicated by a smiling mouth. Therefore, face masks impair mainly our positive social interactions and our ability to understand, and empathize with, one another. Even though in some cultures, a smile may also be taken as a sign of stupidity, shallowness, and even dishonesty, as a large cross-cultural study on social perception of smiling individuals has shown [41]. The most prominent meaning of a smile, however, definitely is a positive emotion.

There are two types of smiles, true smiles and dishonest smiles. A true or genuine smile, also known as a *Duchenne*[5] *smile*, involves both the mouth (the zygomatic major muscle raises the corners of the mouth) and the eyes (the orbicularis oculi muscle raises the cheeks, forms crow's feet around the eyes, and causes the eyebrows to move closer as in frowning). In contrast, dishonest smiles, which are also called "fake smiles", "Botox smiles", "Pan Am smiles[6]" or "non-Duchhenne smiles", involve only the voluntary raising of the corners of the mouth in order to intentionally signal politeness. A recent meta-analysis of Duchenne versus Non-Duchenne smiles found that, overall, Duchenne smiles and people producing Duchenne smiles are rated more positively (i.e., authentic, genuine, real, attractive, trustworthy) than non-Duchenne smiles and people producing non-Duchenne smiles [35]. Moreover, the difference between Duchenne and non-Duchenne smiles was greater when the stimuli were videos rather than photographs (i.e., when smiles were more live-like) and when smiles were elicited naturally rather than through posing paradigms (i.e., when smiles were more authentic).

Given that the real smile involves the upper and the lower half of the face, with the upper half providing the distinctive "frowning" that renders a smile a true smile, there is a lot of room for misunderstanding: Face masks block the smile and allow only the frowning to be communicated – which may actually be *worse than no smile at all!* In general, as face masks cover the bottom half of the face, the ability to detect positive emotions and to discriminate between emotions is considerably impaired. Movements of the lips and the display of teeth are no longer perceptible by the observer, leaving only the top half of the face for detecting the mask-wearer's emotions.

I already mentioned the possibility of interpreting only partially-revealed facial expressions wrongly, i.e., misconstruing frowning and the squinting of the eyes without a visible mouth as skepticism rather than true smiling.[7] In addition, emotions such as surprise or disgust that

utilize the mouth may be mistaken for strongly negative emotions such anger or sadness. In sum, masks may increase the perception of negative emotions and diminish the perception of positive emotions.

In 2017 researchers from the University of Bielefeld published results from an experimental study of emotion recognition, which clearly demonstrated the importance of the eyes and mouth in the perception of emotions from faces. The authors presented single faces of two different individuals expressing Ekman's six basic emotions (as well as a seventh neutral face expression) behind a 6×8 grid of 48 white tiles that were sequentially (in random order) uncovered to 94 student subjects, with subjects instructed to stop the uncovering as soon as they recognize the emotion of the face and name it correctly. For each subject, the experiment consisted of a total of 224 trials (2 face identities times 7 expressions times 16 repetitions per expression).

With this method, it was possible to discern which of the 48 parts of the face contributed to what extend to the observer's recognition of the facial expression being revealed. Results showed that observers relied mostly on tiles that covered and revealed the mouth and eyes when they correctly named the emotion being displayed. In particular, the subjects identified fear and sadness largely by focusing on the eyes whereas disgust and happiness were more successfully identified when subjects focused on the mouth region [74].

If applied to the use of face masks in school settings, these results suggest that happiness and disgust are less likely to be recognized, whereas fear and sadness may be recognized with a higher probability. Given that disgust is an emotion only rarely displayed in school settings, the net result of face masks may well be that the covering of the mouth, i.e., the "organ of smiling", leads to diminished perceived happiness.

In addition, the existence of a face mask may reduce the motivation of the wearer to produce facial expressions in the first place. Since such expressions serve the purpose of communication, the realization of wearing a communications-blocking device will reduce efforts to facially express emotions.

Moreover, according to the "embodied emotions hypothesis" first proposed by William James more than one hundred years ago, not physically displaying emotions reduces their experience. In their view, specific behaviors cause us to experience emotions (and not vice versa), as exemplified in the following statement: "You are not crying because you are sad, but you are sad because you are crying". Accordingly, once you no longer produce a smile, you are less happy. And since the perceiver of your face does not perceive the emotion because of the mask, both the sender and the receiver of the emotional communicative signal will be affected by the face mask.

At the same time, emotional mimicry and thereby emotional contagion [59] is interrupted by the mask as well, i.e., the social phenomenon that we are involuntarily copying the facial expression of other people with whom we communicate. As the emotions of the viewer also follow his expressions, his or her emotions will be blunted as a result. These reactions are typically outside of conscious awareness and occur within half a second [23].

In sum, recognition of, and response to, the outward emotional displays of one's peers' faces is a critical and necessary component of social interaction in schools. It helps pupils and teachers to modify their behavior in order to align with social communication and behavioral norms. When these emotional displays are inhibited by face masks, our ability to communicate effectively with one another is reduced and we are primarily left with mimicking negative (frown) emotions. All of this

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[5] While conducting research on the physiology of facial expressions in the mid-19th century, the French neurologist Guillaume Duchenne identified two distinct types of smiles, one of which later became named after him.

[6] It is named after Pan American World Airways (an airline that no longer exists), whose flight attendants were trained to always smile at their passengers.

[7] This is why plastic surgeons have proposed to use botox, which can be

(*footnote continued*)

injected around the orbicularis occuli muscle to prevent wrinkles around the eyes (no "crow's feet" and no frowning), as a means to prevent mask-induced false social signaling [57]. In addition, oxytocin may be used to dampen down fearful signaling from the eyes and to amplify trust signals and thus work against the detrimental social effects of masks [40].

happens primarily outside of conscious awareness, and hence, is hard to be consciously controlled or even corrected. Since emotions are a major driver of group cohesion, the decreased emotionality, and decreased *positive* emotionality in particular, may interfere with smooth classroom action. Given the fact that the very process of learning is facilitated by emotions (this is their main raison d´être), face masks are likely to cause some interference with pedagogy.

7. Discussion: to mask or not to mask?

In their paper with the same Shakespearian title as this discussion, Eikenberry and coworkers close as follows: "Our findings suggest that face mask use should be as nearly universal (i.e., nation-wide) as possible and implemented without delay, even if most masks are home-made and of relatively low quality. This measure could contribute greatly to controlling the COVID-19 pandemic, with the benefit greatest in conjunction with other non-pharmaceutical interventions [such as physical distancing] that reduce community transmission" ([26], p. 305). German pediatricians have voiced a similar opinion [76]. However, in the light of what has been discussed so far, this can hardly be the final verdict, when it comes to wearing face masks at school to prevent the spread of the present corona pandemic.

In a society within which the large majority of people wear masks, there is a lot of room for mutual emotional misinterpretation and therefore misunderstanding. People may feel that someone is being aggressive towards them, when there is no real intent of aggression (but in fact, a true smile), and may react accordingly – potentially leading to all sorts of difficult, and even dangerous, situations. This regards schools just as well.

Therefore, at the very least, all school professionals should be aware of the detrimental effects of face masks on face recognition and identification, communication, and social-emotional interaction. These should be weighed against the alternatives, i.e., school closures (with the enormous burden on the children and their parents) and school re-openings without masks (with their increased risk of new infections). In Germany, school authorities are rather reluctant to reopen schools after the summer break, but also face increasing criticism for not doing so. In addition, teachers' unions point to the increased risk of elderly teachers to contract a potentially lethal disease.

The ideas of what to do about schooling in times of a pandemic do not exist in a contextual vacuum. In fact, our dealings are far from balanced and contradiction-free: We have to make sure physical distancing in theatres but not in airplanes; we may shop with masks in supermarkets but eat without them in restaurants; we may have assemblies with friends and family but must not have seminars at the university, etc.

Of particular relevance for schools may be the experiences with face masks in hospitals, including psychiatric hospitals, such as the clinic which I am heading. I implemented the general use of face masks for all staff and patients on March 16th 2020, and it soon became clear that they interfere with practicing psychiatry: The decreased emotional observability made the job harder to do. A psychotherapist wrote me an email, noting that socially complicated and challenging inpatients in psychotherapy are very difficult to treat, "as dissociative states and tensions are much harder to detect early enough so that appropriate interventions can be performed. In addition, exposition training (such as in patients after trauma, patients with panic disorder, and patients with obsessive compulsive disorder, OCD) which implies the conscious provocation of anxiety, are hard to do with a face mask obstructing the perception of the patient's emotions. […] Even in diagnostic interviews, face masks interfere with decisions regarding diagnosis and therapy" (Bosch, personal communication [11]).

A hairdresser from another city sent me an email, once the lock-down was over such that he was able to restart his business: "Yesterday I had two new customers, and I must say that I just had to ask them to go outside so we could remove our masks briefly. It is so difficult to give

advice as to what haircut should be done when you cannot fully see the face of the customer. I also talked to my team about how to communicate with masks, as smiles no longer work. We therefore attempt to verbally communicate in a more positive manner in order to counteract the lacking smiles" (taken from [71], p. 184; translation by the author)

I am in no position to rank the settings of psychotherapy, hairdressing or schools in terms of the importance of emotional connection, but these examples do make it clear that schools by no means are the only places where masks can cause difficulties. The general headmaster of the elementary and basic schools (up to grade 10) in Ulm told me that there was a lot of discussion as regards wearing face masks at schools, when the corona-pandemic was roaming through Germany by the middle of March 2020. But even in schools for the mentally retarded and behaviorally challenged students, face masks were implemented and worn by teachers and students. In some schools, physical distancing was implemented, with or without masks. Some teachers as well as other headmasters voiced concerns that they could not imagine teaching with face masks. The headmaster I talked to, in contrast, was quite positive about the possibility to do so in schools, even with young, and challenging, students.

As regards the problems of communication and emotional signaling, it should be noted that emotions can also be decoded from the body posture, a process quite similar to the decoding from faces [30], as well as from prosody (the "melody of speech") and gesture. So the decreases in facial emotion communication can be compensated to some degree. In addition, there is learning. We know from our experience with sensory handicapped people, that they learn to compensate by sharpening their remaining senses. Teachers willing to learn and engage, will find workarounds – even around the blocking by face masks. One of which is simply talking about emotions. Just as in psychotherapy, where learning to talk about emotions (and not just having them) is an important mechanism of coping with emotional distress, students and teachers can learn this – and the pandemic is a good reason to do so.

In addition to the considerations already discussed, the following general remark should be considered: Face masks serve the additional benefit of reminding everybody who is present at school – pupils, teachers, administrative and supporting staff – of the lingering presence of the pandemic and of the appropriate behaviors that are highly important for keeping everybody safe. A face masks protects the person wearing it and the person with whom he or she talks. So using a mask amounts to doing a favor to others and oneself. It may be considered as a prime example of a cultural norm that, if adhered by everybody, benefits the entire society considerably, with little cost to the individual. This idea, in general, is one of the most important pro-social ideas, which have traditionally been promoted by mandatory schooling systems and the states implementing them. So why not use wearing face masks as a simple tool for social behavior training? Other such "tools of the mind" have been widely proposed (music, sports, handcrafts martial arts) to increase attention, executive function, and cognitive control in 4–12 year olds [21],[22].

Finally, when it comes to weighing the pros and cons of face masks, general and specific medical and epidemiological considerations are an important part of the equation. During the height of the pandemic in Germany, little was known about such basics as "how infectious are children/adolescents?", "how effective are face masks really?", "how contagious is the virus" or "are things the same indoors and outdoors?" – This has changed.

We do know, for example, that viral particles in air will be more rapidly diluted outdoors, are sensitive to ambient temperature and relative humidity, and are inactivated by ultraviolet radiation in sunlight. This is why outdoor educational settings, wherever possible, should be highly recommended.

In addition, the verdict on children as regarding their role in infecting other people is not yet in. Whereas some studies indicate that children are less likely to infect others [20,50], some studies find children to be infectious [72]. Adolescents appear to be just as

infectious as adults. Since they also have more daily contacts than older adults, they are the ones who definitely should wear masks in order to protect others, in particular, if they live with their parents and grandparents [9]. If small children in China, South Korea, Japan, and Vietnam can be taught basic rules of hygiene such as handwashing and careful hygiene behavior, children and adolescents in Western societies should be capable of doing it just as well, including wearing face masks.

Finally, the spread of the pandemic is modified by the number of currently infected cases. I write this paper on an island in the German state of Mecklenburg-Vorpommern, on which at the time of writing there were zero cases. So there is no question as to whether schools should open here this fall. In other places, things are less ideal. There is a remaining risk, and the many risks we face in life must always be balanced carefully. By now, schools plan for the fall on a global scale. They must do so responsibly. And face masks should be part of the decision-making process.

Ethical statement

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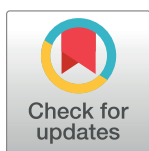
PLOS ONE

Facial masks affect emotion recognition in the general population and individuals with autistic traits

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Abstract

Facial expressions, and the ability to recognize these expressions, have evolved in humans to communicate information to one another. Face masks are equipment used in healthcare by health professionals to prevent the transmission of airborne infections. As part of the social distancing efforts related to COVID-19, wearing facial masks has been practiced globally. Such practice might influence affective information communication among humans. Previous research suggests that masks disrupt expression recognition of some emotions (e.g., fear, sadness or neutrality) and lower the confidence in their identification. To extend the previous research, in the current study we tested a larger and more diverse sample of individuals and also investigated the effect of masks on perceived intensity of expressions. Moreover, for the first time in the literature we examined these questions using individuals with autistic traits. Specifically, across three experiments using different populations (college students and general population), and the 10-item Autism Spectrum Quotient (AQ-10; lower and higher scorers), we tested the effect of facial masks on facial emotion recognition of anger, disgust, fear, happiness, sadness, and neutrality. Results showed that the ability to identify all facial expressions decreased when faces were masked, a finding observed across all three studies, contradicting previous research on fear, sad, and neutral expressions. Participants were also less confident in their judgements for all emotions, supporting previous research; and participants perceived emotions as less expressive in the mask condition compared to the unmasked condition, a finding novel to the literature. An additional novel finding was that participants with higher scores on the AQ-10 were less accurate and less confident overall in facial expression recognition, as well as perceiving expressions as less intense. Our findings reveal that wearing face masks decreases facial expression recognition, confidence in expression identification, as well as the perception of intensity for all expressions, affecting high-scoring AQ-10 individuals more than low-scoring individuals.

Introduction

Charles Darwin's 1872 book, *The Expression of Emotions in Man and Animals*, represents one of the first scientific attempts to study facial expressions. This work provided evidence that emotional expressions are adaptive and evolved to serve functions in the communication of information, including an individual's affective state [1–4]. Since the revival of the importance of Darwin's study of expressions of emotions during 1960s, there has been a surge of research on the perception and expression of emotions in primates, including humans [3].

Humans' ability to recognize facial expressions is evident in infancy, and continues to develop during childhood and into adulthood [5, 6]. However, the affective information is not necessarily distributed homogeneously, with some regions of the face signalling more information regarding emotions than others [7, 8]. For example, individuals tend to inspect another's mouth more when discerning happiness [9]. In general, humans use the mouth more than the eyes to both signal and discriminate facial expressions [9–11]. The recognition patterns of emotions from faces are generally similar among children, adults, and the elderly [12, 13].

Surgical masks (or simply face masks) are used by health professionals to prevent the transmission of airborne infections. As part of the social distancing efforts related to COVID-19, wearing facial masks has been practiced globally. For neurotypicals (NTs), the presence of facial masks results in decreased face recognition abilities when compared to non-masked faces [14–17], resulting in lower accuracy in emotion recognition in both adults [18–22] and children [23]. Moreover, masks cause more disruption than sunglasses in tasks requiring adults to recognize expressions and unfamiliar faces [21]. Facial masks also create confusion, in that disgust can be mistaken for anger, while happy, sad, and anger can be mistaken for neutral emotional expression [22]. For individuals with autism spectrum disorders (ASD), it could be anticipated that masks might create an even greater challenge where facial emotion recognition (FER) is concerned.

ASD are neurodevelopmental disorders that have the hallmark features of restricted interests, repetitive behaviours, and difficulties with social interactions [24]. Since Kanner [25] first described the cases of 11 autistic children and their inability to relate to, or connect with others, much research has been conducted on the perception of emotions in ASD. Disruptions in social interactions may be due, in part, to deficits in recognizing mental states in others [26, 27]. While the research is less clear for children and adolescents with autistic traits [28, 29], the majority of the extant research on adults with ASD suggests a general deficit in FER (for review see [30]). Specifically, when compared to NTs, individuals with autistic traits not only show reduced gaze duration and fixations on other people's eyes [31–33; but see 34], they also spend more time looking at other people's mouths [35, 36, but see 33], and rely more than NTs do on the mouth than the eyes for gauging emotions [30]. Additionally, they are more likely than NTs to begin their exploration of a face in the mouth region [33]. Researchers have also used the "Bubbles" method [37], or Gaussian holes, to occlude various regions of static faces displaying either fear or happiness. Using the "Bubble" method, Spezio et al. [38] found that when emotional information is reduced, high autistic trait individuals are more likely to look to the mouth to identify emotions. This reliance on the mouth region for categorizing emotions in others suggests that the increase in mask wearing for COVID-19 protection will have a greater negative impact on FER abilities for individuals with ASD than it will for the general public.

Although NTs [39], as well as those with autistic traits [40, 41], can use overall body language to facilitate emotion recognition [42, 43], we focus here on static images of the face. While previous studies have investigated the effect of facial mask on FER in NTs, to the best of our knowledge no research has tested facial emotion recognition as a function of facial mask

in high autistic trait individuals. Therefore, in the current study we investigate the effect of facial masks on FER across three experiments using different populations (university students and the general population), and individual difference measures (low and high scorers on an autism quotient scale). Specifically, in Experiment 1 and using a large sample of university students, we test the effect of facial masks (or simply, masks) on FER, as well as the confidence in the recognition of the expressions and the perceived intensity level of those expressions. While recent studies have examined the effect of masks on FER [16, 18–22], only one [22] investigated participants' confidence in their FER abilities with masked faces, and none of the studies asked participants to rate the intensity of emotions in masked conditions. In Experiments 2, we replicate the first experiment using a broader sample from the general population by recruiting participants from Mechanical Turk workers. Finally, in Experiment 3 we investigate the effects of facial masks as a function of high and low scores on the 10-item Autism Spectrum Quotient (AQ-10 [44]).

Experiment 1

In the first experiment, we recruited university students to test the effect of masks and the sex of the stimuli on FER. We predict that facial masks will lead to a general decrease in FER across all emotions.

Method

Participants. A total of 420 individuals (133 men and 287 women), aged between 18 and 36 years (M = 20.33, SD = 2.50), were recruited from the undergraduate Human Subject Pool at the University of British Columbia. Participants received course credit for participation. The study was approved by UBC ethics board.

Stimuli and procedure. Images of eight male and eight female faces (aged between 19 and 31 years), each expressing anger, disgust, fear, happiness, sadness, or neutrality were obtained from the FACES database [45], resulting in 96 stimuli (16 faces x 6 expressions). Another set of 96 stimuli were created by superimposing a facial mask on the original images (see Fig 1 for an example). A within-subjects design was used, and participants randomly observed either the block with facial masks first or the block without the masks first.

After providing online consent to participate, participants were asked to identify the facial expressions in the images, given six choices: anger, disgust, fear, happy, neutral, and sad ("What is the facial expression of this person?"). Participants were also asked to use a sliding scale from 0 to 100 to indicate the level of confidence in their choice ("From 0 to 100%, how confident are you in your choice?"), as well as the perceived level of expressiveness or intensity of that expression ("From 0 to 100%, how much of this emotion is the person expressing?"). The question of expressiveness was not asked for faces that were judged to be neutral.

Results

Facial expression recognition. A generalized linear mixed model was conducted to investigate the effects of facial mask and stimulus sex on the percentage of correct facial expression recognitions, with participant as a random factor. Due to the imbalance of males in our sample, we did not consider participant gender as an effect in our analysis. Results showed significant main effects for Mask and Stimulus Sex (Mask: $\beta = 0.09$, $SE = 0.01$, $\chi^2 (1) = 288.08$, $z = 16.97$, $p < .001$; Stimulus Sex: $\beta = -0.04$, $SE = 0.01$, $\chi^2 (1) = 55.81$, $z = -7.47$, $p < .001$). The main effects were qualified by a significant Mask × Stimulus Sex interaction ($\beta = 0.05$, $SE = 0.01$, $\chi^2 (1) = 24.07$, $z = 4.91$, $p < .001$). Participants were significantly better in correct identification of unmasked male and female facial expressions (Male: $M = 0.94$, $SEM = 0.01$,

Fig 1. Example of six facial expressions of anger, disgust, fear, happiness, neutrality, and sadness (upper row) and their masked counterparts (lower row). Original material from top row stems from MPI FACES database (Ebner et al., 2010).

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95% CI [.93, .95]; Female: M = 0.93, SEM = 0.01, 95% CI [.92, .94]) than masked male and female facial expressions, respectively (Male: M = 0.87, SEM = 0.01, 95% CI [.86, .89], z = -9.97, p < .001; Female: M = 0.81, SEM = 0.01, 95% CI [.79, .82], z = -13.87, p < .001); and better in recognition of masked male emotions than female masked emotions (z = 7.35, p < .001; see S1 Table in S1 File for the frequency and percentage of responses for each facial expression). No difference was observed for the correct identification between unmasked male and unmasked female facial expressions (z = 2.39, p = .101).

Confidence in facial expression recognition. A series of generalized linear mixed models were conducted to investigate the effect of facial mask on the confidence in FER. Each of the expressions were added as a fixed factor and participants as a random factor. Results showed significant main effects of Mask for confidence in all expressions (Anger: β = 0.12, SE = 0.01, χ^2 (1) = 3463.22, z = 58.85, p < .001; Disgust: β = 0.21, SE = 0.01, χ^2 (1) = 11435.80, z = 106.94, p < .001; Fear: β = 0.14, SE = 0.01, χ^2 (1) = 4746.90, z = 68.90, p < .001; Happiness: β = 0.22, SE = 0.01, χ^2 (1) = 12715.46, z = 112.76, p < .001; Neutral: β = 0.12, SE = 0.01, χ^2 (1) = 4010.09, z = 63.33, p < .001; Sadness: β = 0.12, SE = 0.01, χ^2 (1) = 5888.17, z = 76.73, p < .001). Participants were less confident in their recognition of facial expressions of disgust and neutrality behind the masks (Disgust: M = 66.15, SEM = 0.71, 95% CI [64.77, 67.57]; Neutral: M = 72.68, SEM = 0.93, 95% CI [70.87, 74.52];) compared to disgust and neutrality without masks (Disgust: M = 81.98, SEM = 0.88, 95% CI [80.27, 83.73]; Neutral: M = 82.21, SEM = 1.05, 95% CI [80.18, 84.30]).

Additionally, main effects of Stimulus Sex were significant for confidence in all expressions (Anger: β = -0.07, SE = 0.01, χ^2 (1) = 1211.80, z = -34.81, p < .001; Disgust: β = -0.04, χ^2 = 422.00, z = -20.54, p < .001; Fear: β = -0.01, SE = 0.01, χ^2 (1) = 32.61, z = -5.71, p < .001; Happiness: β = 0.01, SE = 0.01, χ^2 (1) = 12.73, z = 3.57, p < .001; Neutral: β = -0.04, SE = 0.01, χ^2 (1) = 371.43, z = -19.27, p < .001; Sadness: β = 0.08, SE = 0.01, χ^2 (1) = 1455.09, z = 38.15, p < .001). Participants were more confident in recognition of disgust and neutrality in male faces (Disgust: M = 75.18, SEM = 0.81, 95% CI [73.61, 76.78]; Neutral: M = 78.76, SEM = 1.01,

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95% CI [76.81, 80.76]) than female faces (Disgust: M = 72.14, SEM = 0.78, 95% CI [70.63, 73.69]; Neutral: M = 75.86, SEM = 0.97, 95% CI [73.98, 77.79]). The significant main effects of Mask and Stimulus Sex for anger, fear, happiness, and sadness were qualified by significant Mask × Stimulus Sex interactions for confidence in anger, fear, happiness, and sadness (Anger: β = 0.04, SE = 0.01, χ^2 (1) = 109.89, z = 10.48, p < .001; Fear: β = 0.02, SE = 0.01, χ^2 (1) = 25.94, z = 5.09, p < .001; Happiness: β = -0.01, SE = 0.01, χ^2 (1) = 6.33, z = -2.52, p = .012; Sadness: β = -0.12, SE = 0.01, χ^2 (1) = 920.42, z = -30.34, p < .001). Participants were more confident in identifying anger and fear in masked male faces (Anger: M = 75.25, SEM = 0.83, 95% CI [72.64, 75.90]; Fear: M = 71.00, SEM = 0.88, 95% CI [69.29, 72.75]) than masked female faces (Anger: M = 67.88, SEM = 0.77, 95% CI [66.39, 69.39], z = 30.97, p < .001; Fear: M = 69.50, SEM = 0.87, 95% CI [67.82, 71.22], z = 7.36, p < .001), while they were more confident in identifying happiness and sadness in masked female faces (Happiness: M = 72.71, SEM = 0.77, 95% CI [71.21, 74.24]; Sadness: M = 71.70, SEM = 0.85, 95% CI [70.06, 73.38]) than masked male faces (Happiness: M = 71.87, SEM = 0.76, 95% CI [70.39, 73.37], z = -4.07, p < .001; Sadness: M = 62.47, SEM = 0.74, 95% CI [61.04, 63.92], z = -46.56, p < .001; see Fig 2). No significant difference was observed for confidence in fear and happiness between unmasked male and female faces (Fear: z = 0.45; Happiness: z = -0.79; ps = .999).

Intensity of expression.   To investigate the effect of facial masks on the intensity of facial expressions, a series of generalized linear mixed models were conducted with each of the expressions as a fixed factor and participants as a random factor. Note that the question of expression intensity was not included for expressions judged to be neutral. Results showed significant main effects of Mask for intensity in all expressions (Anger: β = 0.06, SE = 0.01, χ^2 (1) = 895.82, z = 29.93, p < .001; Disgust: β = 0.16, SE = 0.01, χ^2 (1) = 6189.82, z = 78.68, p < .001; Fear: β = 0.07, SE = 0.01, χ^2 (1) = 1264.25, z = 35.56, p < .001; Happiness: β = 0.27, SE = 0.01, χ^2 (1) = 16730.60, z = 129.40, p < .001; Sadness: β = 0.12, SE = 0.01, χ^2 (1) = 3142.15, z = 56.05, p < .001); participants perceived anger and disgust expressions behind the masks (Anger: M = 66.49, SEM = 0.78, 95% CI [64.98, 68.03]; Disgust: M = 66.45, SEM = 0.70, 95% CI [65.10, 67.83];) as less expressive (lower intensity) than those without masks (Anger: M = 70.73, SEM = 0.83, 95% CI [69.13, 72.38]; Disgust: M = 77.94, SEM = 0.82, 95% CI [76.36, 79.56].

Moreover, the main effects of Stimulus Sex were significant for intensity of all expressions (Anger: β = -0.07, SE = 0.01, χ^2 (1) = 1114.31, z = -33.38, p < .001; Disgust: β = -0.05, SE = 0.01, χ^2 (1) = 680.47, z = -26.09, p < .001; Fear: β = -0.04, SE = 0.01, χ^2 (1) = 445.53, z = -21.11, p < .001; Happiness: β = -0.02, SE = 0.01, χ^2 (1) = 141.20, z = -11.88, p < .001; Sadness: β = 0.04, SE = 0.01, χ^2 (1) = 418.12, z = 20.45, p < .001). Participants perceived male faces (Anger: M = 70.99, SEM = 0.83, 95% CI [69.38, 72.63]; Disgust: M = 73.90, SEM = 0.77, 95% CI [72.40, 75.43]) as more expressive than female faces in anger and disgust (Anger: M = 66.25, SEM = 0.78, 95% CI [64.78, 67.79]; Disgust: M = 70.09, SEM = 0.73, 95% CI [68.66, 71.54]).

The significant main effects of Mask and Stimulus Sex for fear, happiness, and sadness were qualified by significant Mask × Stimulus Sex interactions for intensity of expression in fear, happiness, and sadness (Fear: β = 0.02, SE = 0.01, χ^2 (1) = 32.39, z = 5.69, p < .001; Happiness: β = 0.06, SE = 0.01, χ^2 (1) = 204.14, z = 14.29, p < .001; Sadness: β = -0.17, SE = 0.01, χ^2 (1) = 1615.27, z = -40.19, p < .001). Participants rated fear and happiness in masked male faces (Fear: M = 70.55, SEM = 0.85, 95% CI [68.91, 72.23]; Happiness: M = 60.83, SEM = 0.76, 95% CI [59.36, 62.34]) as more expressive than masked female faces (Fear: M = 66.81, SEM = 0.80, 95% CI [65.26, 68.41], z = 18.53, p < .001; Happiness: M = 57.60, SEM = 0.72, 95% CI [56.20, 59.03], z = 17.30, p < .001), while they rated sadness in masked female faces (M = 63.92, SEM = 0.82, 95% CI [62.33, 65.55]) as more expressive compare to masked male faces (M = 56.15, SEM = 0.72, 95% CI [54.76, 57.58], z = -41.56, p < .001; see Fig 3). No significant difference was observed for intensity in happiness between unmasked male and female faces (z = -1.84, p = .396).
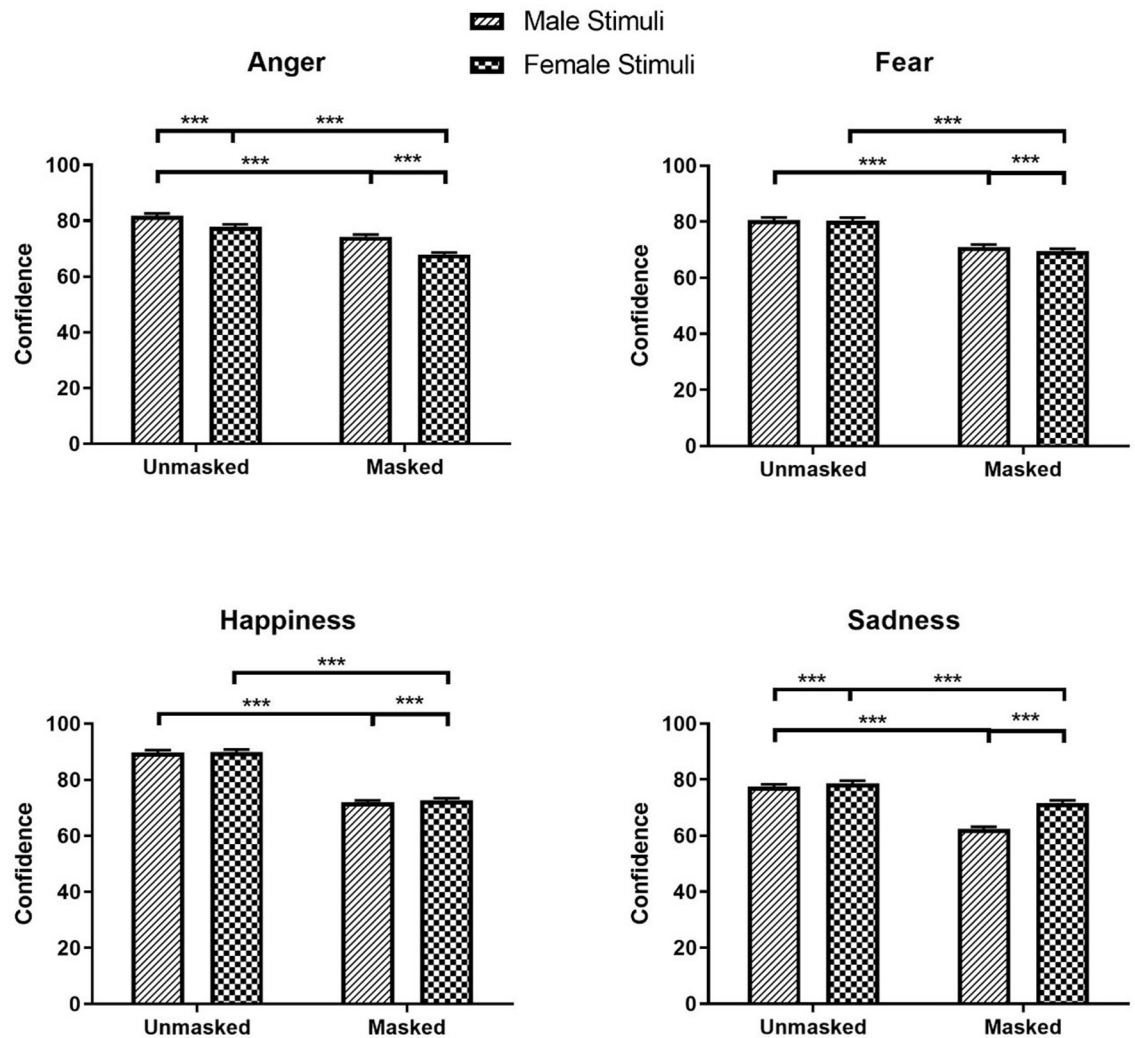
Fig 2. Confidence ratings for anger, fear, happiness, and sadness as a function of mask and stimuli sex. $^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.

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Fig 3. Intensity of expression ratings for fear, happiness, and sadness as a function of mask and stimuli sex. $^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.

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Discussion

Using a sample of university students, the effect of facial masks on FER was investigated and the results showed that participants were better in FER of unmasked faces than masked faces. Furthermore, participants were better in FER in male masked faces than in female masked faces. Participants were less confident in their recognition of all investigated expressions behind the masks than facial expressions without masks. The overall confidence in FER was also sensitive to the sex of the faces, as participants were more confident in recognition of anger, disgust, fear, and neutrality in male faces, but more confident in recognition of happiness and sadness in female faces. When faces were masked, participants were more confident in their identification of anger and fear in male faces than in female faces, while they were more confident in identifying sadness in masked female faces than in masked male faces. Yet, all of the emotions were rated as less expressive when under a mask. While male faces were rated as more expressive in anger, disgust, fear, and happiness, and female faces were more expressive in sadness, participants rated fear and happiness in masked male faces as more expressive than in masked female faces, and rated sadness in masked female faces as more expressive than in masked male faces.

Using a database similar to the one used in the current study, Carbon [22] did not find a significant difference between masked and unmasked fear and neutral expressions. One potential explanation for this difference between our study and Carbon's concerns the number of stimuli used and participants tested. While in the Carbon study 41 individuals rated the emotions of 12 identities (a combination of young, middle-aged, and older faces), we recruited 420 participants to identify the emotions of 16 young identities. Our larger population, as well as our larger set of stimuli within a coherent age group, may have yielded a more robust effect, revealing that recognition of all emotions, including fear and neutral faces, are affected by wearing a mask. Moreover, by using a larger sample size, our analyses had the power to test for the interactions between mask and stimulus sex on FER. However, there are still limitations to our study, for example, using a sample of only university students. Therefore, in the next study we aimed to test the effect of facial masks on FER within a more general population.

Experiment 2

Experiment 2 tested if the results of Experiment 1 generalise to a broader population. We recruited participants from Amazon Mechanical Turk workers.

Method

Participants. A total of 199 individuals (130 men and 69 women), aged between 18 and 73 years ($M = 34.58$, $SD = 10.18$) were recruited through Amazon Mechanical Turk (MTurk) from the United States to complete an online survey. Participants provided online consent to participate. MTurk's robustness is extensively researched and results support it as a valid means of collecting online data for the behavioural sciences, sometimes even superior to in-person collection [46]. MTurk subjects are often more representative of the U.S. population than in-person convenience samples, but they might be less representative than subjects in Internet panels or national probability sampling [46–48]. A total of 141 participants (70.9%) reported being married, and 3.5% as being divorced, widowed, or separated; an additional 19.6% reported being single, and 6.0% in a relationship. In terms of their highest academic degree, 10.1% had a high school diploma, 6.0% had a post-secondary diploma, 47.7% of the participants had an undergraduate degree, and 35.7% had a post-graduate degree (MA or PhD).

Stimuli and procedure. Twelve young faces, six male and six female, with six emotional expressions (anger, disgust, fear, happiness, sadness, and neutral) were obtained from the FACES database [45], resulting in 72 stimuli. Another set of 72 stimuli were created by super-imposing a facial mask on the original photos. The faces used in this experiment were a subset of faces used in Experiment 1. The reduction of stimuli (a total of 192 trials in Experiment 1 to 144 in Experiment 2) was to reduce the length of the study and the risk of participants dropping out [49, 50]. A within-subjects design was used, and participants randomly observed either the block with facial masks first or the block without the masks first. The rest of the procedure, including the questions asked, was as in Experiment 1.

Results

Facial expression recognition. A generalized linear mixed model was conducted to investigate the effect of facial masks, and stimulus sex on the percentage of correct facial expression recognitions, with participant as a random factor. Once again, due to the imbalance of males in our sample, we did not consider participant gender as an effect in our analysis. Results showed significant main effects for Mask and Stimulus Sex (Mask: $\beta = 0.14$, $SE = 0.01$, $\chi^2(1) = 165.76$, $z = 12.87$, $p < .001$; Stimulus Sex: $\beta = 0.05$, $SE = 0.01$, $\chi^2(1) = 18.64$, $z = 4.32$, $p < .001$). These main effects were qualified by a significant Mask × Stimulus Sex interaction ($\beta = -0.06$, $SE = 0.02$, $\chi^2(1) = 8.83$, $z = -2.97$, $p = .003$). Participants were significantly poorer in correct identification of expressions in masked female faces ($M = 0.59$, $SEM = 0.02$, 95% CI [.55, .63];) than expressions in masked male faces ($M = 0.67$, $SEM = 0.02$, 95% CI [.63, .71], $z = -4.36$, $p < .001$) and unmasked female faces ($M = 0.77$, $SEM = 0.02$, 95% CI [.73, .80], $z = -10.99$, $p < .001$); and poorer in recognition of masked male emotions than unmasked male emotions ($M = 0.78$, $SEM = 0.02$, 95% CI [.74, .82], $z = -7.59$, $p < .001$; see S2 Table in S1 File for the frequency and percentage of responses for each facial expression). No difference was observed for the correct identification between unmasked male and unmasked female facial expressions ($z = -1.26$, $p = .999$).

Confidence in facial expression recognition. A series of generalized linear mixed models were conducted to investigate the effect of masks on the confidence in facial expression recognition. Each of the expressions were added as a fixed factor and participants as a random factor. Similar to the results of Experiment 1, participants in Experiment 2 were less confident in their recognition of the facial expressions behind the masks in all expressions (Anger: $M = 74.18$, $SEM = 1.00$, 95% CI [72.25, 76.16]; Disgust: $M = 71.84$, $SEM = 0.98$, 95% CI [69.94, 73.79]; Fear: $M = 75.98$, $SEM = 1.07$, 95% CI [73.92, 78.10]; Happiness: $M = 73.57$, $SEM = 1.04$, 95% CI [71.57, 75.63]; Neutral: $M = 72.52$, $SEM = 1.11$, 95% CI [70.38, 74.73]; Sadness: $M = 71.56$, $SEM = 1.01$, 95% CI [69.62, 73.56]) compared to the facial expressions without masks (Anger: $M = 76.96$, $SEM = 1.03$, 95% CI [74.96, 79.02], $\beta = 0.04$, $SE = 0.01$, $\chi^2(1) = 124.39$, $z = 11.15$, $p < .001$; Disgust: $M = 78.50$, $SEM = 1.07$, 95% CI [76.43, 80.63], $\beta = 0.09$, $SE = 0.01$, $\chi^2(1) = 716.86$, $z = 26.77$, $p < .001$; Fear: $M = 78.33$, $SEM = 1.10$, 95% CI [76.20, 80.52], $\beta = 0.03$, $SE = 0.01$, $\chi^2(1) = 86.89$, $z = 9.32$, $p < .001$; Happiness: $M = 82.33$, $SEM = 1.16$, 95% CI [80.09, 84.63], $\beta = 0.11$, $SE = 0.01$, $\chi^2(1) = 1194.26$, $z = 34.56$, $p < .001$; Neutral: $M = 77.23$, $SEM = 1.18$, 95% CI [74.95, 79.58], $\beta = 0.06$, $SE = 0.01$, $\chi^2(1) = 360.72$, $z = 18.99$, $p < .001$; Sadness: $M = 76.42$, $SEM = 1.07$, 95% CI [74.34, 78.55], $\beta = 0.07$, $SE = 0.01$, $\chi^2(1) = 387.38$, $z = 19.68$, $p < .001$). However, participants were more confident in recognition of disgust and neutrality in male faces (Disgust: $M = 75.54$, $SEM = 1.03$, 95% CI [73.54, 77.59]; Neutral: $M = 75.16$, $SEM = 1.15$, 95% CI [72.94, 77.45]) than in female faces (Disgust: $M = 74.66$, $SEM = 1.02$, 95% CI [72.69, 76.69], $\beta = 0.01$, $\chi^2 = 12.39$, $z = 3.52$, $p < .001$; Neutral: $M = 74.51$, $SEM = 1.14$, 95% CI [72.31, 76.78], $\beta = 0.01$, $\chi^2 = 6.90$, $z = 2.63$, $p = .009$)

The significant main effects of Mask and Stimulus Sex for anger and sadness were qualified by significant Mask × Stimulus Sex interactions for confidence in anger and sadness (Anger: β = -0.02, SE = 0.01, χ^2 (1) = 13.30, z = -3.65, p < .001; Sadness: β = 0.05, SE = 0.01, χ^2 (1) = 60.99, z = 7.81, p < .001). Participants were more confident in identifying anger in masked male faces (M = 75.04, SEM = 1.02, 95% CI [73.06, 77.07]) than in masked female faces (M = 73.33, SEM = 1.00, 95% CI [71.39, 75.32], z = -4.89, p < .001), while they were more confident in identifying sadness in masked female faces (M = 73.45, SEM = 1.05, 95% CI [71.43, 75.53]) than in masked male faces (M = 69.71, SEM = 0.99, 95% CI [67.79, 71.69], z = 10.90, p < .001; see Fig 4). No significant difference was observed for confidence in anger and sadness between unmasked male and female faces (Anger: z = 0.22; Sadness: z = 0.03; ps = .999).

Intensity of expression. To investigate the effect of facial masks on the perception of intensity of facial expressions, a series of generalized linear mixed models were conducted with each of the expressions as a fixed factor and participants as a random factor. Results showed significant main effects of Mask for intensity in all expressions (Anger: β = 0.04, SE = 0.01, χ^2 (1) = 115.12, z = 282.38, p < .001; Disgust: β = 0.08, SE = 0.01, χ^2 (1) = 547.82, z = 23.41, p < .001; Fear: β = 0.02, SE = 0.01, χ^2 (1) = 27.23, z = 5.22, p < .001; Happiness: β = 0.14, SE = 0.01, χ^2 (1) = 1818.54, z = 42.64, p < .001; Sadness: β = 0.06, SE = 0.01, χ^2 (1) = 300.90, z = 17.35, p < .001); participants perceived facial expressions of disgust and fear under the masks (Disgust: M = 69.14, SEM = 0.98, 95% CI [67.25, 71.09]; Fear: M = 72.41, SEM = 1.07, 95% CI [70.34, 74.53]) as less expressive (less intense) than those without masks (Disgust: M = 74.84, SEM = 1.06, 95% CI [72.79, 76.94]; Fear: M = 73.69, SEM = 1.09, 95% CI [71.58, 75.86]). Moreover, the main effects of Stimulus Sex were significant for intensity of anger, disgust, and happiness (Anger: β = 0.01, χ^2 = 11.71, z = 3.42, p < .001; Disgust: β = 0.08, χ^2 = 25.59, z = 5.06, p < .001; Happiness: β = 0.02, χ^2 = 33.93, z = 5.83, p < .001); participants perceived male faces (Disgust: M = 72.55, SEM = 1.03, 95% CI [70.56, 74.59]) as more expressive than female faces in disgust (Disgust: M = 71.32, SEM = 1.01, 95% CI [69.37, 73.33]).

The significant main effects of Mask and Stimulus Sex for anger, happiness, and sadness were qualified by significant Mask × Stimulus Sex interactions for intensity in happiness and sadness (Anger: β = -0.02, SE = 0.01, χ^2 (1) = 5.58, z = -2.36, p = .018; Happiness: β = -0.05, SE = 0.01, χ^2 (1) = 62.68, z = -7.92, p < .001; Sadness: β = 0.10, SE = 0.01, χ^2 (1) = 221.20, z = 14.87, p < .001). Participants rated anger and happiness in masked male faces (Anger:
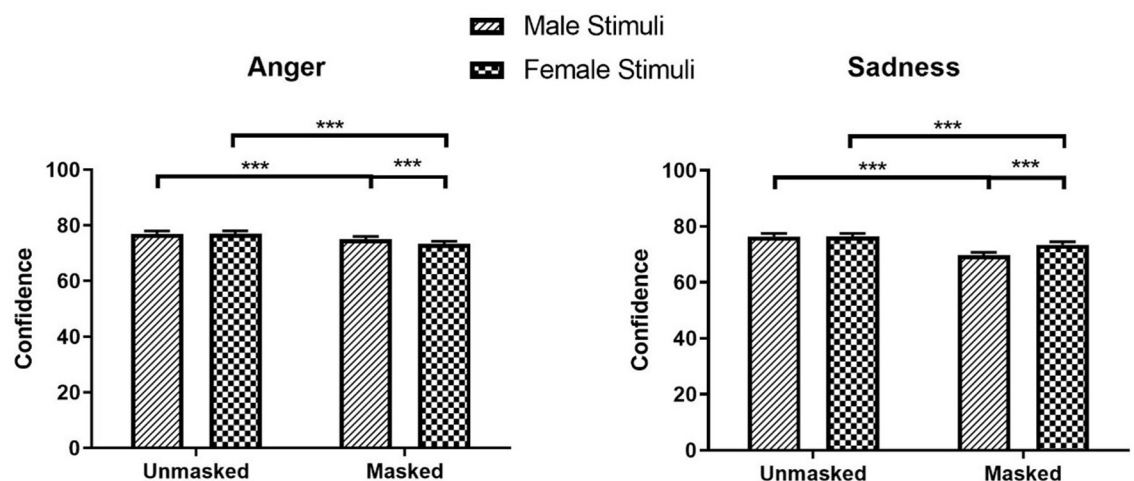

Fig 4. Confidence ratings for anger and sadness as a function of mask and stimuli sex. * p < 0.05, ** p < 0.01, *** p < 0.001.

$M = 69.68$, $SEM = 1.07$, 95% CI [67.61, 71.80]; Happiness: $M = 68.48$, $SEM = 1.01$, 95% CI [67.75, 71.82]) as more expressive than in masked female faces (Anger: $M = 68.31$, $SEM = 1.05$, 95% CI [66.29, 70.40]; Happiness: $M = 65.37$, $SEM = 0.97$, 95% CI [63.50, 67.29], $z = -9.38$, $p < .001$), while they rated sadness in masked female faces ($M = 66.93$, $SEM = 1.09$, 95% CI [64.83, 69.11]) as more intense than masked male faces ($M = 63.27$, $SEM = 1.15$, 95% CI [61.28, 65.33], $z = 11.21$, $p < .001$; see Fig 5). No significant difference was observed for intensity in anger and happiness between unmasked male and female faces (Anger: $z = -0.76$; Happiness: $z = 1.54$; $ps > .747$), or between unmasked and masked sad female faces ($z = -1.75$; $p = .479$).

Discussion

The second experiment aimed to test if the results of Experiment 1, which used a university student sample, replicate in the general population. Results from Mechanical Turk workers showed that similar to Experiment 1, participants' FER decreased significantly as a function of facial mask, and that participants were less confident in their recognition of the facial expressions behind the masks. This significant difference was observed for all expressions. Moreover, all facial expressions under the masks were rated as less expressive than those without masks, and male faces were considered more expressive in anger, disgust, and happiness compared to female faces.

Experiment 3

Our final study examined the effect of a facial mask on FER for high autistic trait individuals. Given that individuals with autistic traits place more importance than NTs do on the mouth to recognize facial expressions, we predict that a facial mask will make FER particularly difficult for people with autistic traits. Specifically, they will be less accurate than NTs at FER, and that masks will negatively impact their FER accuracy more than they do NTs'.

Method

Participants. One hundred and forty-two participants were recruited from the Human Subject Pool at the University of British Columbia according to the school's ethical guidelines, and received extra credit for agreeing to participate. Participants provided online consent to participate. All participants completed the 10-item Autism Spectrum Quotient (AQ-10; [44]) prior to the experiment, and they had no way of knowing that their AQ-10 score was relevant

Fig 5. Intensity of expression ratings for anger, happiness, and sadness as a function of mask and stimuli sex. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

to the present study. The AQ-10 includes 10 items from the 50-item Autism Spectrum Quotient (AQ; [26]), and was designed to be a quick and effective screening method for ASD. The AQ-10 scores reliably in specificity (0.91), sensitivity (0.88), and has a positive predictive value of 0.85 [44]. An individual who scores 6 or higher on the AQ-10 is referred for a full diagnostic assessment. For individuals with ASD, the AQ-10 yields a mean score of 7.93, and for NTs a mean score of 2.77 [44]. Thus, higher scores on the AQ-10 indicate more autistic traits have been endorsed.

Participants were divided into two groups: "high scorers", comprised of participants who scored 6 or higher on the AQ-10, and "low scorers", which included participants who scored 5 or lower on the AQ-10. This division yielded 71 participants (50 women) between the ages of 18 and 29 ($M = 20.39$, $SD = 2.27$) in the high scorers' group, and 71 (51 women) between the ages of 18 and 39 ($M = 20.52$, $SD = 2.98$) in the low scorers' group.

Stimuli and procedure. The same stimuli and procedures were used from Experiment 1.

Results

Facial expression recognition. A linear generalized mixed model was conducted to investigate the effects of AQ-10 (high vs. low score) and masks on the percentage of correct facial expression recognitions, with participants as a random factor. As in the previous two experiments, we did not consider participant gender as an effect in our analysis due to the imbalance of males in our sample. Results showed significant main effects for Mask and AQ-10, however their interaction was not significant (Mask: $\beta = 0.09$, $SE = 0.01$, $\chi^2 (1) = 99.05$, $z = 9.95$, $p < .001$; AQ-10: $\beta = -0.05$, $SE = 0.01$, $\chi^2 (1) = 31.84$, $z = -5.64$, $p < .001$; Mask × AQ-10: $\beta = -0.01$, $SE = 0.02$, $\chi^2 (1) = 0.04$, $z = -0.21$, $p = .837$). Participants were significantly better in facial expression recognition (FER) of unmasked facial expressions ($M = 0.95$, $SEM = 0.01$, 95% CI [.94, .96]) than masked facial expressions ($M = 0.86$, $SEM = 0.01$, 95% CI [.85, .88]). Moreover, results showed those participants who scored 5 or lower ("low scorers") on the AQ-10 ($M = 0.93$, $SEM = 0.01$, 95% CI [.92, .94]) were significantly better in FER compared to high scorers (those who scored 6 or above) on the AQ-10 ($M = 0.88$, $SEM = 0.01$, 95% CI [.87, .89]).

The main effects of AQ10 and Stimulus Sex were qualified by a significant AQ10 × Sex Stimulus interaction, $\beta = -0.05$, $SE = 0.02$, $\chi^2 (1) = 8.72$, $z = -2.95$, $p = .003$: High scorers were better at FER for male stimuli ($M = 0.91$, $SEM = 0.01$, 95% CI [.90, .93]) than in female stimuli ($M = 0.85$, $SEM = 0.01$, 95% CI [.83, .87], $z = 4.62$, $p < .001$) Additionally, high scorers were significantly poorer in recognition of female FER compared to low scorers ($M = 0.92$, $SEM = 0.01$, 95% CI [.91, .94], $z = 5.59$, $p < .001$). No other interaction was observed. See S3 Table in S1 File for the frequency and percentage of responses for each facial expression as a function of facial mask, AQ-10, and stimulus sex. No difference was observed for the correct expression identification of male and female faces for low scorers ($z = -0.99$; $p = .999$), and between low and high scorers for male faces ($z = 2.05$; $p = .240$).

Confidence in facial expression recognition. A series of generalized linear mixed models were conducted to investigate the effect of masks on the confidence in facial expression recognition, as a function of AQ-10 and Stimulus sex. Each of the expressions were added as a fixed factor and participants as a random factor. Result showed significant main effects of Mask for anger, disgust, fear happiness, neutrality, and sadness (Anger: $\beta = 0.10$, $SE = 0.01$, $\chi^2 (1) = 784.25$, $z = 28.00$, $p < .001$; Disgust: $\beta = 0.20$, $SE = 0.01$, $\chi^2 (1) = 3343.21$, $z = 57.82$, $p < .001$; Fear: $\beta = 0.13$, $SE = 0.01$, $\chi^2 (1) = 1380.68$, $z = 37.16$, $p < .001$; Happiness: $\beta = 0.21$, $SE = 0.01$, $\chi^2 (1) = 3934.59$, $z = 62.73$, $p < .001$; Neutral: $\beta = 0.11$, $SE = 0.01$, $\chi^2 (1) = 1180.21$, $z = 34.35$, $p < .001$; Sadness: $\beta = 0.16$, $SE = 0.01$, $\chi^2 (1) = 2086.57$, $z = 45.68$, $p < .001$), while the main effect of AQ-10 for anger, disgust, happiness, and neutrality were significant (Anger: $\beta = -0.09$,

$SE = 0.04$, $\chi^2 (1) = 6.03$, $z = -2.46$, $p = .014$; Disgust: $\beta = -0.11$, $SE = 0.04$, $\chi^2 (1) = 8.38$, $z = -2.89$, $p < .001$; Happiness: $\beta = -0.10$, $SE = 0.03$, $\chi^2 (1) = 10.77$, $z = -3.28$, $p = .001$; Neutral: $\beta = -0.10$, $SE = 0.01$, $\chi^2 (1) = 6.78$, $z = -2.60$, $p = .009$). The effects of Stimulus Sex for anger, disgust, neutrality, and sadness were significant (Anger: $\beta = -0.07$, $SE = 0.01$, $\chi^2 (1) = 373.98$, $z = -19.34$, $p < .001$; Disgust: $\beta = -0.03$, $SE = 0.01$, $\chi^2 (1) = 75.19$, $z = -8.67$, $p < .001$; Neutral: $\beta = -0.05$, $SE = 0.01$, $\chi^2 (1) = 228.38$, $z = -15.11$, $p < .001$; Sadness: $\beta = 0.09$, $SE = 0.01$, $\chi^2 (1) = 674.16$, $z = 25.96$, $p < .001$).

The significant main effects of Mask and AQ-10 were qualified by a significant Mask × AQ-10 interactions for disgust, fear, neutral, and sad faces (Disgust: $\beta = 0.03$, $SE = 0.01$, $\chi^2 (1) = 17.84$, $z = 4.22$, $p < .001$; Fear: $\beta = 0.03$, $SE = 0.01$, $\chi^2 (1) = 24.31$, $z = 4.93$, $p < .001$; Neutral: $\beta = 0.06$, $SE = 0.01$, $\chi^2 (1) = 89.46$, $z = 9.46$, $p < .001$; Sadness: $\beta = 0.05$, $SE = 0.01$, $\chi^2 (1) = 58.65$, $z = 7.66$, $p < .001$). High scorers were more confident in FER for disgust, fear, neutral, and sad unmasked faces (Disgust: $M = 75.53$, $SEM = 2.11$, 95% CI [71.51, 79.77]; Fear: $M = 77.06$, $SEM = 2.30$, 95% CI [72.69, 81.70]; Neutral: $M = 80.15$, $SEM = 2.25$, 95% CI [75.86, 84.69]; Sadness: $M = 74.91$, $SEM = 2.14$, 95% CI [70.83, 79.24]) compared to masked faces (Disgust: M = 68.97, SEM = 1.93, 95% CI [65.30, 72.85], $z = -42.82$, $p < .001$; Fear: M = 66.80, SEM = 1.99, 95% CI [63.00, 70.82], $z = -29.23$, $p < .001$; Neutral: M = 69.32, SEM = 1.95, 95% CI [65.60, 73.24], $z = -30.33$, $p < .001$; Sadness: M = 62.20, SEM = 1.78, 95% CI [58.80, 65.80], $z = -37.09$, $p < .001$). High scorers (Disgust: M = 60.90, SEM = 1.70, 95% CI [57.65, 64.33]; Neutral: M = 69.32, SEM = 1.95, 95% CI [65.60, 73.24]) were significantly less confident than low scorers (Disgust: M = 69.24, SEM = 1.93, 95% CI [65.56, 73.14], $z = 3.25$, $p = .007$; Neutral: M = 79.29, SEM = 2.23, 95% CI [75.04, 83.78], $z = 3.38$, $p = .004$) in identifying disgust and neutral masked emotions (Fig 6). No difference was observed between low and high scorers for confidence in disgust ($z = 2.51$; $p = .072$), fear ($z = 1.43$; $p = .910$), neutrality ($z = 1.81$; $p = .425$), and sadness ($z = 1.25$; $p = .999$) of unmasked face; and between low and high scorers for confidence in fear ($z = 2.23$; $p = .156$) and sad ($z = 2.57$; $p = .062$) masked faces.

Results also showed a significant three-way Mask × AQ-10 × Stimulus Sex interaction for anger and happiness (Anger: $\beta = -0.03$, $SE = 0.01$, $\chi^2 (1) = 4.56$, $z = -2.14$, $p = .033$; Happiness: $\beta = 0.05$, $SE = 0.01$, $\chi^2 (1) = 13.42$, $z = 3.66$, $p < .001$). High scorers were more confident in identifying anger in masked male faces ($M = 70.90$, $SEM = 1.84$, 95% CI [67.37, 74.61]) compared to masked female faces ($M = 65.14$, $SEM = 1.70$, 95% CI [61.90, 68.56], $z = 11.90$, $p < .001$), but less confident compared to unmasked male faces ($M = 78.03$, $SEM = 2.03$, 95% CI [74.16, 82.11], $z = -14.10$, $p < .001$). High scorers were also more confident in anger recognition for unmasked female faces ($M = 72.13$, $SEM = 1.88$, 95% CI [68.54, 75.90]) compared to masked female faces ($z = -14.38$, $p < .001$), but less confident compared to unmasked male faces ($z = 11.62$, $p < .001$; Fig 7).

High scorers were less confident in identifying happiness in masked male faces ($M = 69.90$, $SEM = 1.52$, 95% CI [66.98, 72.95]) than happiness in unmasked male faces ($M = 77.07$, $SEM = 1.68$, 95% CI [73.85, 80.42], $z = -31.69$, $p < .001$). They were also less confident than low scorers' ($M = 86.39$, $SEM = 1.87$, 95% CI [82.79, 90.14], $z = 3.17$, $p = .043$) in identifying happiness in masked male faces. Similarly, high scorers were less confident in identifying happiness in masked female faces ($M = 68.75$, $SEM = 1.50$, 95% CI [65.87, 71.75]) compared to happiness in unmasked female faces ($M = 87.00$, $SEM = 1.89$, 95% CI [83.38, 90.78], $z = 4.45$, $p < .001$), and less confident than low scorers ($M = 78.84$, $SEM = 1.71$, 95% CI [75.55, 82.27], $z = -35.14$, $p < .001$) in identifying happiness in masked female faces.

The results of post hoc comparison for the effect of masks on the degree of drop in FER confidence showed a greater reduction in confidence for fear, neutral, and sad faces for high scorers compared to low scorers. The mean difference in confidence ratings between masked and unmasked sad faces was 12.71 for high scorers, but only 9.78 for low scorers. Similarly,
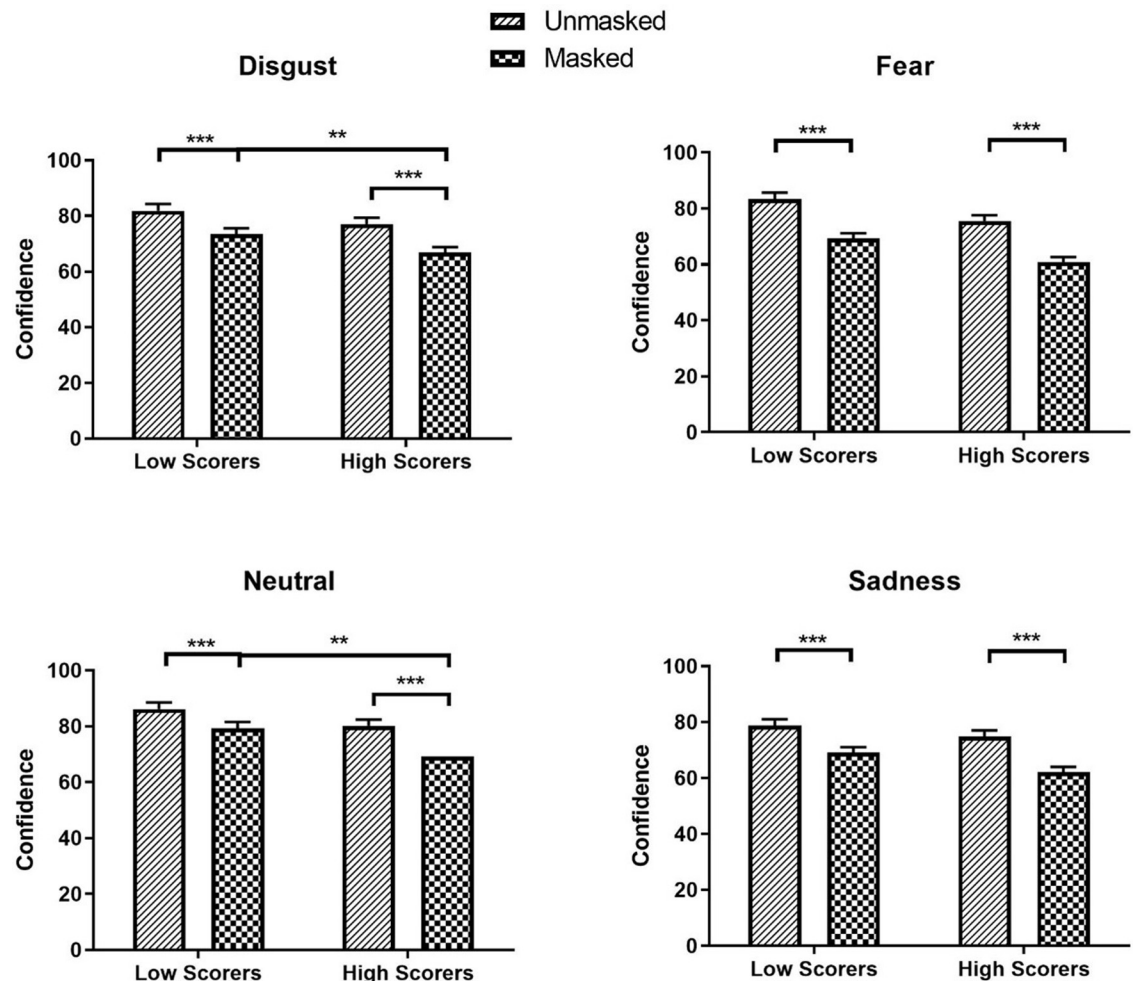
Fig 6. Confidence ratings for disgust, fear, neutral and sadness as a function of mask and AQ-10. $* \ p < 0.05$, $** \ p < 0.01$, $*** \ p < 0.001$.

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results show that high scorers' mean difference between the two conditions for neutral faces was 10.83, but only 6.82 for low scorers. The reduction in confidence between unmasked and masked fearful faces for high scorers was 10.26, while only 8.48 for low scorers.

Intensity of expression. To investigate the effect of facial masks on the ratings of intensity of facial expressions, a series of generalized linear mixed models were conducted with each of the expressions as a fixed factor and participants as a random factor. Note that the question of expression intensity was not included for the neutral expression. Results showed significant main effects of Mask for intensity in all expressions (Anger: $\beta = 0.05$, $SE = 0.01$, $\chi^2 (1) = 232.45$, $z = 15.25$, $p < .001$; Disgust: $\beta = 0.16$, $SE = 0.01$, $\chi^2 (1) = 2168.43$, $z = 46.57$, $p < .001$; Fear: $\beta = 0.08$, $SE = 0.01$, $\chi^2 (1) = 545.44$, $z = 23.35$, $p < .001$; Happiness: $\beta = 0.28$, $SE = 0.01$, $\chi^2 (1) = 6148.34$, $z = 78.41$, $p < .001$; Sadness: $\beta = 0.13$, $SE = 0.01$, $\chi^2 (1) = 1291.58$, $z = 34.94$, $p < .001$). Participants perceived anger under the masks (Anger: $M = 66.90$, $SEM = 1.29$, 95% CI [64.41, 69.48]) as less expressive (less intense) than without masks (Anger: $M = 70.61$, $SEM = 1.36$, 95% CI [67.98, 73.33]). Moreover, low scorers on the AQ-10 (Anger: $M = 71.95$, $SEM = 1.96$, 95% CI [68.22, 75.89]) perceived anger as more expressive than high scorers (Anger: $M = 65.64$, $SEM = 1.79$, 95% CI [62.23, 69.24], $\beta = -0.09$, $SE = 0.04$, $\chi^2 (1) = 5.68$, $z = -2.38$, $p = .017$).
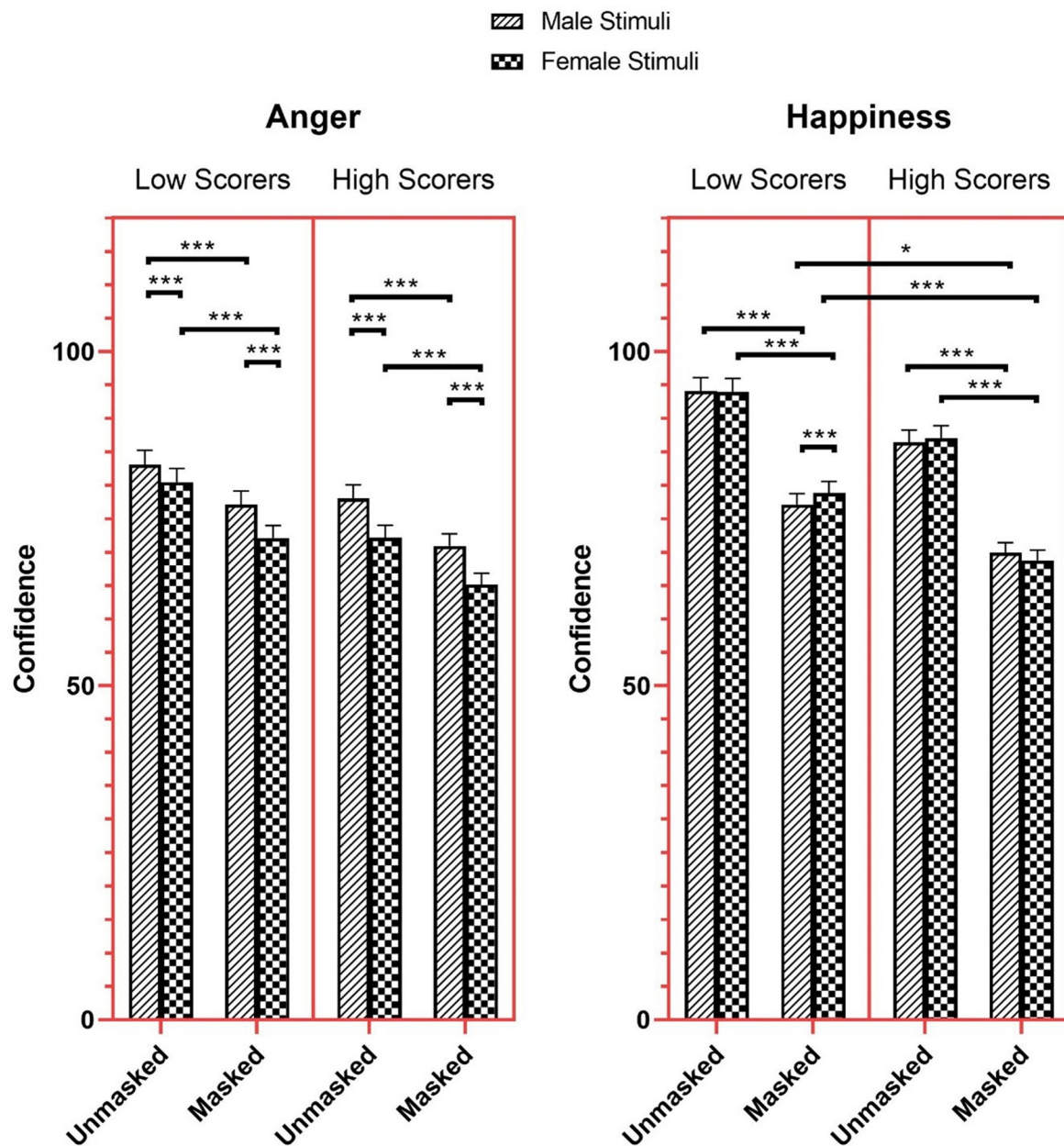
Fig 7. Confidence ratings for anger and happiness as a function of mask, AQ-10, and stimuli sex. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

https://doi.org/10.1371/journal.pone.0257740.g007

Additionally, the main effects of Stimulus Sex were significant for intensity of all expressions (Anger: $\beta = -0.07$, $SE = 0.01$, $\chi^2 (1) = 393.25$, $z = -19.38$, $p < .001$; Disgust: $\beta = -0.05$, $SE = 0.01$, $\chi^2 (1) = 228.76$, $z = -15.12$, $p < .001$; Fear: $\beta = -0.04$, $SE = 0.01$, $\chi^2 (1) = 134.50$, $z = -11.60$, $p < .001$; Happiness: $\beta = -0.03$, $SE = 0.01$, $\chi^2 (1) = 67.71$, $z = -7.86$, $p < .001$; Sadness: $\beta = 0.06$, $SE = 0.01$, $\chi^2 (1) = 299.27$, $z = 17.30$, $p < .001$). Participants perceived male faces (Anger: $M = 71.18$, $SEM = 1.37$, 95% CI [68.54, 73.93]) as more expressive than female faces in anger (Anger: $M = 66.36$, $SEM = 1.28$, 95% CI [63.89, 68.92]).

The significant main effects of Mask and AQ-10 were qualified by a significant Mask × AQ-10 interaction for sadness ($\beta = 0.02$, $SE = 0.01$, $\chi^2 (1) = 6.21$, $z = 2.49$, $p = .013$). High scorers

perceived sadness as more expressive in unmasked faces ($M = 65.04$, $SEM = 1.92$, 95% CI [61.39, 68.91]) compared to masked faces ($M = 56.46$, $SEM = 1.67$, 95% CI [53.29, 59.83], $z = -26.64$, $p < .001$; Fig 8). The AQ-10 × Stimulus Sex interaction was also significant for disgust ($\beta = -0.01$, $SE = 0.01$, χ^2 (1) = 4.37, $z = -2.09$, $p = .037$). High scorers perceived disgust in both male ($M = 70.47$, $SEM = 1.67$, 95% CI [67.27, 73.82]) and female faces ($M = 66.37$, $SEM = 1.58$, 95% CI [63.36, 69.53]) as less expressive compared to low scorers' perception of disgust in male ($M = 77.20$, $SEM = 1.83$, 95% CI [73.70, 80.87], $z = 2.72$, $p = .039$) and female faces ($M = 73.78$, $SEM = 1.75$, 95% CI [70.43, 77.29], $z = 3.15$, $p = .010$), respectively. Also, high scorers perceived male faces as more expressive in disgust than female faces ($z = 11.91$, $p < .001$; Fig 8). No difference was observed between low and high scorers for confidence in sadness for both masked ($z = 2.46$; $p = .083$) and unmasked face ($z = 2.02$; $p = .258$).

The results also returned significant three-way Mask × AQ-10 × Stimulus Sex interactions for fear and happiness (Fear: $\beta = 0.05$, $SE = 0.01$, χ^2 (1) = 12.45, $z = 3.53$, $p < .001$; Happiness: $\beta = 0.08$, $SE = 0.01$, χ^2 (1) = 30.71, $z = 5.54$, $p < .001$). High scorers perceived fear in masked male face ($M = 67.94$, $SEM = 1.75$, 95% CI [64.59, 71.46]) as more expressive than masked female faces ($M = 64.12$, $SEM = 1.65$, 95% CI [60.96, 67.45], $z = 8.02$, $p < .001$), and less expressive than male unmasked faces ($M = 72.49$, $SEM = 1.87$, 95% CI [68.92, 76.24], $z = -9.26$, $p < .001$, Fig 9). Additionally, high scorers perceived fear in unmasked female faces ($M = 71.05$, $SEM = 1.83$, 95% CI [67.56, 74.73]) as more expressive than masked female face ($z = -14.39$, $p < .001$).

High scorers perceived happiness in female masked faces ($M = 52.78$, $SEM = 1.41$, 95% CI [50.10, 55.61]) as less expressive compared to low scorers ($M = 63.07$, $SEM = 1.67$, 95% CI [59.88, 66.44], $z = 4.74$, $p < .001$). Moreover, high scorers perceived happiness in female masked faces as less expressive than female unmasked faces ($M = 75.56$, $SEM = 2.00$, 95% CI [71.75, 79.58], $z = -48.33$, $p < .001$) and male masked faces ($M = 58.42$, $SEM = 1.55$, 95% CI [55.45, 61.54], $z = 12.90$, $p < .001$, Fig 9). High scorers also perceived masked male faces as less expressive in happiness than unmasked male faces ($M = 74.64$, $SEM = 1.97$, 95% CI [70.86, 78.61], $z = 33.89$, $p < .001$). For histogram and density plot of the confidence and expression intensity data as a function of AQ-10, Mask, and Stimulus Sex see S1 File.

Discussion

Testing the effect of facial mask on FER in low and high AQ-10 scorers showed that high scorers (those who endorsed more autistic traits) had less accuracy in FER than low scorers (those
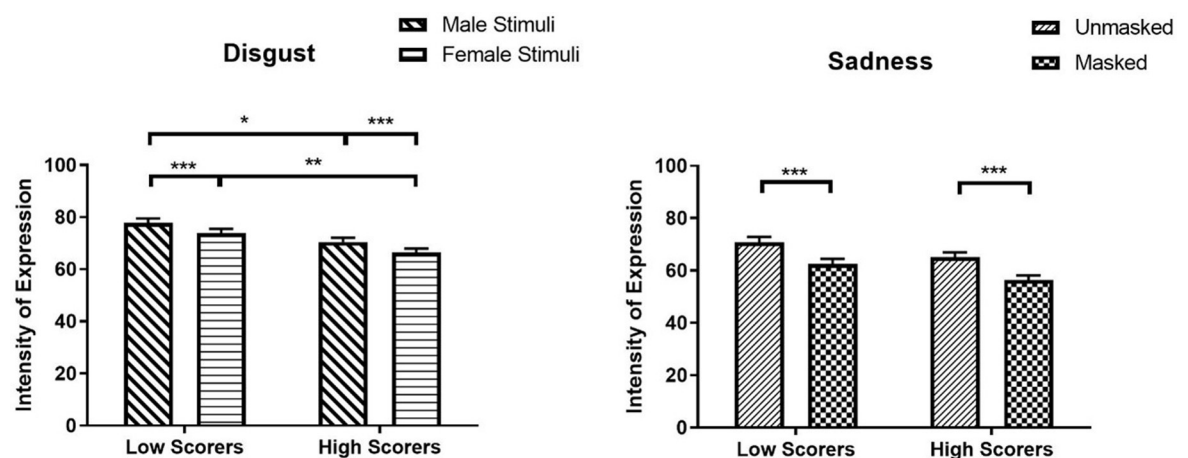
Fig 8. Intensity of expression ratings for disgust and sadness as a function of mask and AQ-10. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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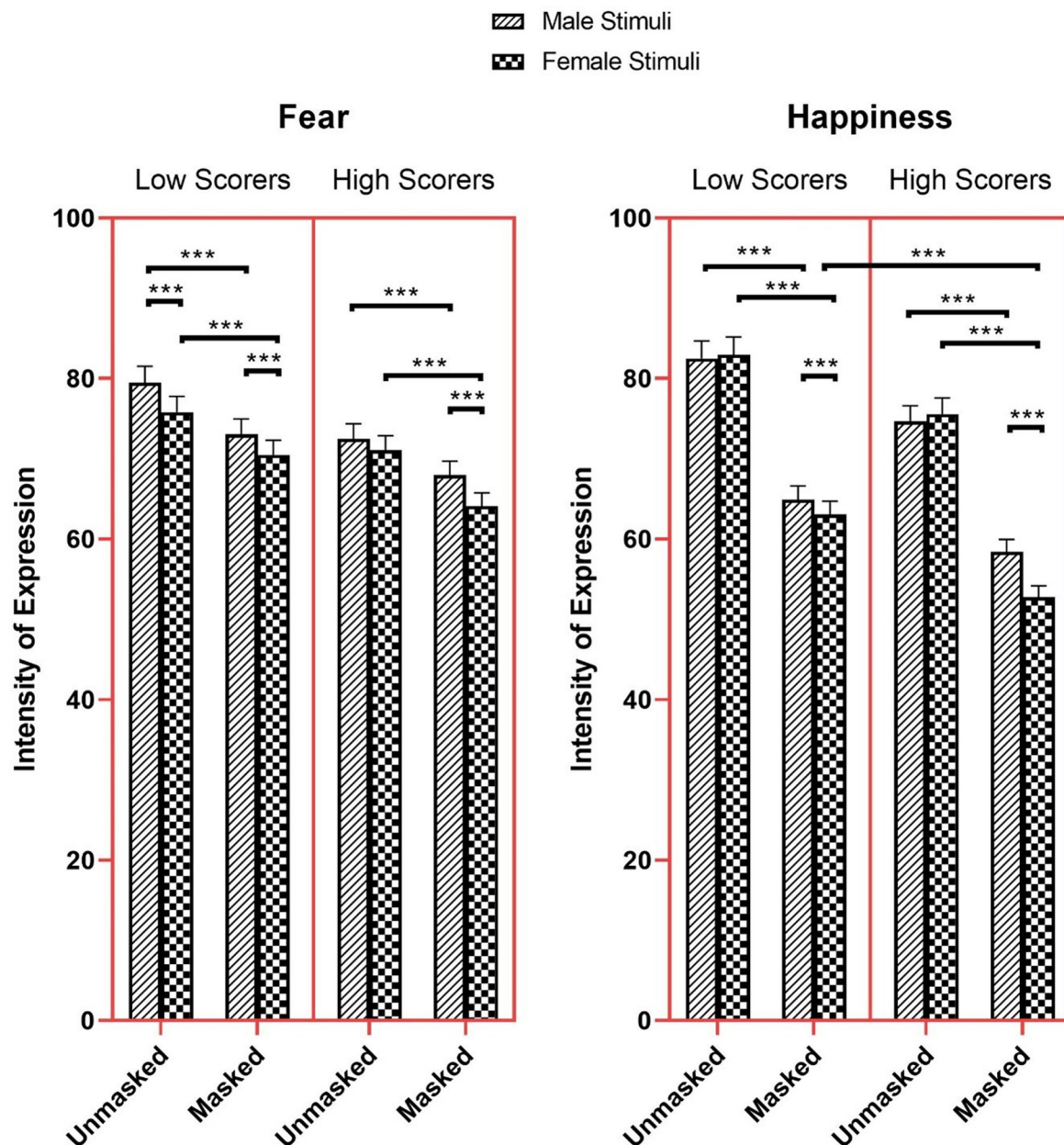
Fig 9. Intensity of expression ratings for fear and happiness as a function of mask, AQ-10 and stimuli sex. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

who endorsed few autistic traits), which supports previous research (deficits in identifying anger, disgust, fear [30, 51], sadness, surprise [30], and happiness [51]). Additionally, high scorers were less confident than low scorers in recognizing emotions labeled as anger, disgust, happiness, and neutral in unmasked faces, while they were less confident in recognizing masked faces labeled as disgust and neutral compared to low scorers. Furthermore, high scorers rated all of the emotions as less intense than did low scorers. They also rated male faces displaying disgust and fear, as well as masked female faces displaying happiness, as less intense than did low scorers.

Similar to the overall results in the previous experiments, high scorers on the AQ-10 were better at FER in male faces than in female faces, and were more confident in the recognition of anger in male faces compared to anger in female faces. While both high and low scorers' confidence dropped significantly from unmasked to masked emotions of fear, neutral, and sad faces, the drop in confidence trended towards being larger for high scorers. Additionally, similar to low scorers, high scorers performed best when identifying unmasked faces labeled as happy. This supports previous reports that people with ASD are most accurate when identifying faces expressing happiness [30].

Recall that we hypothesised that high scorers on the AQ-10 would show deficits in FER when compared to low scorers. The results showed this to be the case. However, we also predicted that the introduction of masks would impede FER in high scorers more than they would in low scorers. This was not supported by the data. This lack of support is unexpected given that prior research has found that people use the mouth to identify happiness [52] and disgust [9], the eyes to discern fear and sadness [9], and that individuals with ASD look less at the eyes of fearful or neutral faces [53]. While masks caused a greater drop in confidence for high scorers than low scorers in expressions labeled as fear, neutral, and sad, there was no significant interaction between AQ-10 scores and masks for FER, despite high scorers rating both the intensity of emotions and their confidence in their FER ability lower than low scorers.

General discussion

Since the outbreak of COVID-19, health organizations have encouraged the general public to wear facial masks in order to curb its spread. While masks help combat against infection, they also hinder day-to-day social interactions, with previously unknown impact on individuals with autistic traits. As these individuals have been shown to have deficits in reading the emotions of others, the introduction of masks in daily social interactions was anticipated to have a greater impact on them than neurotypicals (NTs). Across three experiments we investigated the influence of masks on facial emotion recognition (FER). We tested the effect of masks on recognition of anger, disgust, fear, happiness, neutrality, and sadness in male and female faces using different samples (university students in Experiment 1, and the general population in Experiment 2), as well as examined the role of autistic traits (scores on the 10-item Autism Spectrum Quotient). We also assessed the confidence of participants in their judgements, and their perceived intensity of facial expressions. Overall our results showed that the introduction of masks disrupted participants' FER ability, their confidence in judging facial expressions, and their perception of emotion intensity.

Participants' accuracy in expression recognition decreased when faces were masked, a finding that was observed across all three studies, supporting previous research that reported similar findings [18, 21, 22]. Participants in the current study were also more accurate in FER when categorizing male versus female faces, although participants in Experiment 2 showed this pattern only in the masked condition.

Masks also affected confidence in FER. In all three experiments, participants were less confident in their judgements for all emotions in the mask condition compared to the unmasked condition, results that dovetail with the recent work by Carbon [22]. In the current study, participants were also less confident in identifying anger in female masked faces than male masked faces. For Experiments 1 and 2, participants were also less confident in identifying sadness in masked male faces than in masked female faces.

Because recent work has not addressed the effect that masks may have on the perception of emotional intensity, we asked participants to rate the level of expression (or intensity) in faces with and without masks. Across the three experiments, masks resulted in all facial expressions

being perceived as less intense. These findings extend the research on the impact of wearing masks, beyond disruptions in FER accuracy and confidence. Sex differences in perception of expression intensity were also found: Experiments 1 and 2 returned higher ratings of sadness in masked female faces compared to masked male faces, and more intense perceptions of happiness for masked male faces than masked female faces. Additionally, participants in Experiment 2 perceived a higher intensity of anger in masked male faces than in masked female faces, while participants in Experiment 1 rated fear as more intense in masked male faces than in masked female faces.

Finally, Experiment 3 examined how traits of autism are related to perceptions of emotion expression. Recent research on COVID-19's impact on the autistic population has seen a focus on areas such as disruption of routines or services, how caregivers coped during lockdown, and mask tolerance training [54–59]. To extend the ASD and COVID-19-related research, we examined the effects of masks on possible social interactions for individuals with autistic traits in terms of FER, participants' confidence in their FER abilities, and their perception of facial emotion intensity.

Our results showed that compared to low scorers (participants who scored 5 or lower on the AQ-10), high scorers (those who scored 6 or higher) were significantly less accurate overall in FER, supporting findings from previous research [30]. However, we found no significant interaction between AQ-10 scores and masks. Given that masks cover the bottom half of the face, this result is counter to previous research that showed individuals with autistic traits preferentially look towards the mouth when viewing faces [35, 36, but see 33], and that they rely more on the mouth region than NTs for categorizing emotions [38]. One possible explanation for our results may be rooted in Social Motivation Theory (SMT; [60]), which proposes that individuals with autistic traits can attend to salient social cues when prompted to do so, or if they believe doing so can help complete a task. The wearing of a mask, then, could serve as a visual prompt for autistic individuals to actively search for emotional clues elsewhere on the face.

To the best of our knowledge, this is the first study to examine the effect of facial masks on intensity ratings of expressions in autistic individuals' perception of emotion in the faces of others. However, our finding that high scorers rated the expressions in the stimuli as significantly less intense than low scorers does align with previous findings that autistic individuals have difficulty with rating emotions in unmasked faces [61]. Perceiving emotions as less intense, and therefore less informative, also aligns with our additional finding that high scorers reported being significantly less confident than low scorers in their ability to recognize anger, disgust, happiness, and neutral emotions in faces. Extending the research on autistic individuals' confidence in FER, we found their confidence trended lower for masked fear, neutral, and sad faces. We are unaware of previous studies examining autistic individuals' confidence in their FER abilities while viewing masked faces, although our results support Bekele et al. [62] who found autistic adolescents were less confident than controls (but similarly accurate) in FER in tasks involving unmasked faces. Note, however, that Sawyer et al. [63], found autistic participants to be similarly confident to controls (but less accurate) in FER tasks that also involved unmasked faces. This apparent discrepancy appears to reflect the Dunning-Kruger effect, whereby a person can either over-estimate or under-estimate their ability at a task [64]. The bias that is expressed by those who trend towards autism seems to depend on the aspect of the task that is emphasised. When performance is emphasised—as in our study and that of Bekele et al. [62]—participants underestimate their competence (i.e., their confidence is below average). And when confidence is emphasised, as in Sawyer et al. [63] who instructed participants to choose the level that balanced speed and accuracy, participants overestimate their competence (i.e., their performance is below average).

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As in the first two experiments, high scorers in Experiment 3 were less confident in identifying anger in masked female faces than in masked male faces, and high scores rated happiness in masked male faces as more intense than in masked female faces. High scorers were also less confident than low scorers in categorizing happiness in both male and female masked faces. Similar to Experiment 1, high scorers rated fear as more intense in masked male faces than in masked female faces. Thus, while the introduction of masks did not hinder FER accuracy significantly more for high scorers on the AQ-10, high scorers' confidence in emotion recognition and perception of emotional intensity for certain emotions were impacted by masks more than low scorers. Confidence was particularly reduced for high scorers when viewing masked faces labeled as disgust, happy, or neutral, whereas female masked faces labeled as happiness, and disgust were rated as significantly less intense.

In summary, our results support previous research showing that wearing facial masks decreases both facial expression recognition [18, 21, 22], and confidence in expression identification [22]. Contrary to previous research that found no effects of facial masks on recognition of fear [22], neutrality [18, 21, 22] or sadness [21] our studies showed that facial masks disrupt recognition of all investigated emotions. We also had the novel finding that perception of expression intensity of anger, disgust, fear, happiness, neutrality, and sadness were reduced by masks. Our novel finding that high AQ-10 scorers were lower in FER accuracy, FER confidence, and emotion perception relative to low AQ-10 scorers when viewing masked faces adds to the extant COVID-19 autism-related research, as well as to the broader FER and ASD research. These novel findings are consistent with previous research findings that people with autistic traits have greater difficulty than NTs in FER [30, 65, 66]. Our results suggest that the introduction of mask wearing in the current pandemic climate will reduce confidence in people with autistic traits in FER, particularly when attempting to discern fearful, neutral, or happy faces. The current investigation also extends the previous research by showing that masks affect all expressions in terms of recognition, confidence in identification, and intensity perception. Moreover, this research contributes to the literature by confirming these effects in individuals with autistic traits and comparing them with neurotypicals.

Possible limitations in the current study include that reaction times were not recorded. While there were no significant differences between the two AQ-10 groups in FER accuracy for masked faces, it is not possible to determine whether or not high scorers took longer to label facial expressions. As autistic individuals can take longer to process faces [67, 68], future studies should examine potential differences in response times between individuals with autistic traits and neurotypicals.

Another limitation was that our participants were predominantly female for all three studies. Had there been a better balance between male and female participants, we could have explored differences between males and females. Additionally, the images used in the study exhibited emotions at their peak intensity, which is not always the case during natural social interactions. Given that high scorers reported the expressions in the stimuli as less intense than low scorers did, their confidence and accuracy might be further reduced when interacting with others in day-to-day social situations when expressions might not be delivered at peak intensity, with or without masks. Moreover, all three experiments were conducted online, and while online experiments are shown to be reliable and have external validity [69], we suggest that future research investigate the effect of facial masks in FER by testing individuals who score high and low on the AQ-10 in person. Also, as dynamic stimuli can facilitate emotion perception [42, 43], we suggest it would be instructive to examine the effect of facial masks on FER when NTs and autistic individuals are presented with dynamic versus static images.

In conclusion, across three experiments in which we tested individuals from different populations and with different levels of autistic traits, we found that facial masks have a negative

effect on facial expression recognition. Wearing facial masks also reduces the intensity of the emotion that is being perceived and observers' confidence in their ability to correctly identify the emotion, particularly so for those with autistic traits.

Supporting information

S1 File. S1-S3 Tables and histogram and density plots.
(DOCX)

Author Contributions

Conceptualization: Farid Pazhoohi, Alan Kingstone.

Formal analysis: Farid Pazhoohi.

Supervision: Alan Kingstone.

Writing – original draft: Farid Pazhoohi, Leilani Forby.

Writing – review & editing: Farid Pazhoohi, Leilani Forby, Alan Kingstone.

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From:	Elliott, Jennifer (DH/MS)
To:	Elliott, Jennifer (DH/MS)
Subject:	Letter to the Pediatricians_JE
Date:	April 5, 2022 7:12:40 PM
Attachments:	Letter to the Pediatricians_JE.docx

26(1)(a)

From:	Elliott, Jennifer (DH/MS)
To:	Chalifoux, Mathieu (DH/MS); Liston, Heidi (DH/MS)
Cc:	Burkhardt, Tracey (DH/MS); Elliott, Jennifer (DH/MS)
Subject:	RE: URGENT- Student benefits and risks
Date:	April 5, 2022 7:12:53 PM
Attachments:	Letter to the Pediatricians_JE.docx
Importance:	High

Thanks Matt,

Some further updates – added immunization and copying Tracey for additional review and feedback.

Jennifer

From: Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>

Sent: Tuesday, April 5, 2022 6:43 PM

To: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

Good evening Deputy,

As discussed, please see attached my first go at the draft.

You can see my planned structure as a comment at the top.

26(1)(a) ██
██
████████████████████████████████████

Looking forward to your comments.

Thanks,

Matt

From: Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>

Sent: April 5, 2022 5:52 PM

To: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

Please find the updated version attached.

Thanks,

Arifur

From: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>

Sent: April 5, 2022 4:06 PM

To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>; Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: Re: URGENT- Student benefits and risks

Good idea

Get Outlook for iOS

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Sent: Tuesday, April 5, 2022 3:57:25 PM

To: Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>; Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

26(1)(a) ██

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Jennifer

From: Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>

Sent: Tuesday, April 5, 2022 1:45 PM

To: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

Hi all,

Please find a draft of the letter attached, please feel free to edit.

Thanks,

Arifur

From: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>

Sent: April 5, 2022 9:38 AM

To: Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>; Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: Re: URGENT- Student benefits and risks

Agree on. Co-signers also whatever depicts the peak best for graph for simplicity

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From: Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>

Sent: Tuesday, April 5, 2022 9:02:54 AM

To: Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

Dr. Rahman, I've sent you the letter.

Thanks,

Matt

From: Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>

Sent: April 5, 2022 9:00 AM

To: Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>; Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

It would be appreciated if I could receive the letter written by the pediatricians.

Thanks,

Arifur

From: Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>

Sent: April 5, 2022 8:11 AM

To: Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

Took a quick look at it. Forget how we translate POCT and PCR.

Matt

From: Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>

Sent: April 5, 2022 8:05 AM

To: Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>; Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

Someone should get this slide translated **ASAP**

Bruce Macfarlane

Communications Director / Directeur des communications

Department of Health / Ministère de la Santé

Tel/tél 506-444-4583

Cell 506-476-1376

From: Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>

Sent: Tuesday, April 5, 2022 7:38 AM

To: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>; Rahman, Dr. Arifur (DH/MS) <Dr.Arifur.Rahman@gnb.ca>; Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Macfarlane, Bruce (DH/MS) <Bruce.Macfarlane@gnb.ca>; Burkhardt, Tracey (DH/MS) <Tracey.Burkhardt@gnb.ca>

Subject: RE: URGENT- Student benefits and risks

Good morning Deputy,

Please find requested graph attached. Did we want to show January onwards or did we want to show cases since lifting of MO on March 14th?

Would it be helpful to include Dr. Hoyt or one of our other mental health professionals to co-sign this letter?

We may also want to reach out to EECD and see if they want to co-sign re: impacts on children?

Thanks,

Matt

26(1)(a)

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Heidi

Get Outlook for iOS

From: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>

Sent: Monday, April 4, 2022 5:19 PM

To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Cc: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>

Subject: Re: Student benefits and risks

Ok, great. Many thanks!

Get Outlook for iOS

From: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>

Sent: Monday, April 4, 2022 5:19:05 PM

To: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>

Cc: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>

Subject: RE: Student benefits and risks

Yes Annie and CRT team also pulling some info together.

Jennifer

From: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>
Sent: Monday, April 4, 2022 5:16 PM
To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>
Cc: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>; Chalifoux, Mathieu (DH/MS) <Mathieu.Chalifoux@gnb.ca>
Subject: Student benefits and risks

26(1)(a)

Heidi

Get Outlook for iOS

From:	Higgs, Premier Blaine (PO/CPM) []
To:	EECD Correspondence (EECD/EDPE) [EECD.Correspondence@gnb.ca]
Subject:	FW: Please NO masks in schools! Pleading parent
Date:	Tuesday, April 05, 2022 10:57:46

_____

Leaving with you for response. Please copy the Premier.

Thank you,

Sheri Forsythe

Correspondence Coordinator/Coordinatrice de la correspondance

Office of the Premier/Cabinet du premier ministre

From: 21(1)
Sent: Tuesday, April 5, 2022 9:08 AM
To: Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>; Hogan, Bill Hon. (JPS/JSP) <Bill.Hogan@gnb.ca>; Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>; Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Please NO masks in schools! Pleading parent

ATTENTION! External email / courriel externe.

Good day,

I write to you today due to the rumour of masks going back in school. I beg of you not to proceed with that change. My child begs of you to leave leave the masks off. I cannot

imagine how hard this change has been for some who are very scared much like they cannot believe how hard the past couple year have been for my child. Throughout the past few weeks being mask free at school the light in my child has finally coming back on. For the better part of two years I have had a depressed little boy who cried daily going to school, who shut down and hated every second of anything related to it which killed my soul.

Since opening up and removing masks he is a whole new kid. He is happier, he is no longer crying daily at drop off and begging me to pick him up so he doesn't have to go to daycare. It was absolutely 100% due to the masking because those are gone, the world is brighter and his attitude about life has changed for the better. He felt trapped, claustrophobic, sickly, the way he describes it he felt his individuality and identity was gone. I know this sounds dramatic but it is the truth he is someone who just cannot take it. He is almost 7 years old and doesn't have a clue how fun school is supposed to be which I am not sure if that's a blessing or a curse because he doesn't know yet really what he is missing. School for him is really the only place he would get to see friends and grow socially through the pandemic and we were all failing him.

Please I beg of you to leave it how it is. Those who are comfortable taking the risks can continue to be mask free and those who are scared or nervous and maybe for completely valid reasons can continue to mask. I personally am compromised and unable (medically) to get a second dose so of course I was a little bit nervous but my child's mental well-being needs to be my priority! We all had COVID in my family earlier this calendar year and it wasn't fun, and I understand it could have been worse, but I would take that many times over instead of seeing the sad state of children's mental health.

The reality is that this is airborn as has been discussed by medical professionals and   masks have to come off throughout the day to eat and drink, kids are in small shared rooms all day, and kids don't wear them right either. I see this daily at the schools. Teachers and students are handling them, putting them random unsanitary places, and they are handled so much it is totally negating the effectiveness of them if there even is much with cloth masks that majority wear. I would send 15-20 per day and my son might wear 4-5 so more than most and each one would come home so disgusting that I cannot imagine that was ever on his face.

Our children are the future, our children need to see us take action that supports people of all kinds not just one group and our children really need to see the path forward and

some normalcy before we start losing them to other health crisis'. We all need our path forward, we need to up our game in cleanliness and personal hygiene, we need to stay away from others if feeling even slightly unwell, businesses need to be accepting/understanding of missed time due to illness and more than anything we need to move forward and learn to love one another and respect personal choices again and live with COVID.

Thank you for reading this.

Sincerely,

21(1) ███████████

███████████

From:	Higgs, Premier Blaine (PO/CPM) []
To:	EECD Correspondence (EECD/EDPE) [EECD.Correspondence@gnb.ca]
Subject:	FW: NO MASKS IN SCHOOL
Date:	Tuesday, April 05, 2022 07:57:00

_____

And another one

For Department's response and please copy the Premier.

Thank you,

Sheri Forsythe

Correspondence Coordinator / Coordinatrice de la correspondance

Office of the Premier/Cabinet du premier ministre

From: 21(1) ███████████████████████
Sent: Monday, April 4, 2022 7:25 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: NO MASKS IN SCHOOL

ATTENTION! External email / courriel externe.

DON'T YOU DARE BRING MASKS BACK TO OUR SCHOOLS. OUR KIDS NEED TO
BE ABLE TO SEE EACH OTHER PROPERLY. SPEECH ISSUES INCREASED
DRAMATICALLY DURING YOUR INSANE MASK POLICY. STUDIES HAVE SHOWN
THAT THESE LITTLE CLOTH MASKS DON'T DO SHIT. IF YOU DARE BRING THIS
SHIT BACK YOU CAN EXPECT MASSIVE BLOW BACK. WE ARE BORN FREE AND
WE WILL REMAIN FREE SO GET THAT THROUGH YOUR THICK SKULL OLD MAN.

21(1) ███████████

███████████████

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From:	Higgs, Premier Blaine (PO/CPM) []
To:	EECD Correspondence (EECD/EDPE) [EECD.Correspondence@gnb.ca]
Subject:	FW: NO to mandatory masks in school!
Date:	Tuesday, April 05, 2022 07:55:41

_____

For Department's response and please copy the Premier.

Thank you,

Sheri Forsythe

Correspondence Coordinator / Coordinatrice de la correspondance

Office of the Premier/Cabinet du premier ministre

From: 21(1) ████████████████████
Sent: Monday, April 4, 2022 11:00 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Cc: Thériault, Isabelle (LEG) <Isabelle.Theriault@gnb.ca>
Subject: NO to mandatory masks in school!

ATTENTION! External email / courriel externe.

Mr. Higgs,

The legacy medias and a small group of parents have been asking to bring back

mandatory masks in school. As parents, we would like to say that we are so happy that our kids are now mask-free especially at school. More and more studies show that masks are ineffective and also harmful.

Kids need to build their immune systems and being confined and/or forced to wear masks is not beneficial for their health. People who believe that masks are working and protecting them are free to wear them. It should be a personnal choice!

Thank you,

21(1)

Sent from my Galaxy

From:	Higgs, Premier Blaine (PO/CPM) []
To:	EECD Correspondence (EECD/EDPE) [EECD.Correspondence@gnb.ca]
Subject:	FW: Information - Mask
Date:	Monday, April 04, 2022 16:01:01
Attachment 1:	masks-are-neither-effective-nor-safe.pdf
Attachment 2:	Denis G. Rancourt PhD April 2020 _Masks Don't Work_ A review of science relevant to COVID-19 social

policy_.pdf

Attachment 3:	Rapport-William-Code-(signé).pdf

_____

For Department's response and please copy the Premier.

Thank you,

Emily Wilcox

Records Coordinator / Coordinatrice des documents

Office of the Premier/Cabinet du premier ministre

From: 21(1) ███████████████████████

Sent: Monday, April 4, 2022 3:52 PM

To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>

Subject: Information - Mask

ATTENTION! External email / courriel externe.

Hi,

I am reaching out as a concerned parent of 2 students that attends public school.   It is rumored that masking could possibly be brought back to our schools.   I am NOT in favor of this at all.   Many of our own "top medical drs" across the country has openly said wearing mask does not stop the spread of the COVID virus.

I have attached some medical studies that confirm that the Mask are neither safe nor effective.   I as a parent with the advice of my medical doctor and research have the right and the obligation to make medical decisions for my children.   This is not something the Minister of Education, provincial or Federal government has a right to do.

If you have scientific studies, you are willing to share that contradicts the attached, I would be more than happy to review and possibly change my mind on the mask.

It is time we learn to live with COVID and be a free country that the people get to make their own medical decisions without being discriminated against.

Respectfully,

21(1)

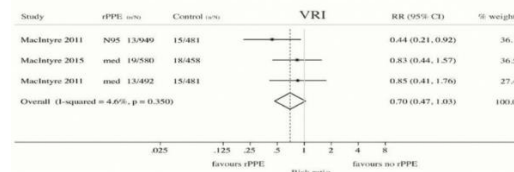# Masks Are Neither Effective nor Safe
The Scientific Literature

1. T Jefferson, M Jones, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. MedRxiv. 2020 Apr 7. ~~ https://www.medrxiv.org/content/10.1101/2020.03.30.20047217v2

2. J Xiao, E Shiu, et al. Nonpharmaceutical measures for pandemic influenza in non-healthcare settings – personal protective and environmental measures. Centers for Disease Control. 26(5); 2020 May. ~~ https://wwwnc.cdc.gov/eid/article/26/5/19-0994_article

3. J Brainard, N Jones, et al. Facemasks and similar barriers to prevent respiratory illness such as COVID19: A rapid systematic review. MedRxiv. 2020 Apr 1. ~~ https://www.medrxiv.org/content/10.1101/2020.04.01.20049528v1.full.pdf

4. L Radonovich M Simberkoff, et al. N95 respirators vs medical masks for preventing influenza among health care personnel: a randomized clinic trial. JAMA. 2019 Sep 3. 322(9): 824-833. ~~ https://jamanetwork.com/journals/jama/fullarticle/2749214

5. J Smith, C MacDougall. CMAJ. 2016 May 17. 188(8); 567-574. ~~ https://www.cmaj.ca/content/188/8/567

6. F bin-Reza, V Lopez, et al. The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence. 2012 Jul; 6(4): 257-267. ~~ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5779801/\

7. J Jacobs, S Ohde, et al. Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: a randomized controlled trial. Am J Infect Control. 2009 Jun; 37(5): 417-419. ~~ https://pubmed.ncbi.nlm.nih.gov/19216002/

8. M Viola, B Peterson, et al. Face coverings, aerosol dispersion and mitigation of virus transmission risk. ~~ https://arxiv.org/abs/2005.10720, x ~~ https://arxiv.org/ftp/arxiv/papers/2005/2005.10720.pdf

9. S Grinshpun, H Haruta, et al. Performance of an N95 filtering facepiece particular respirator and a surgical mask during human breathing: two pathways for particle penetration. J Occup Env Hygiene. 2009; 6(10):593-603. ~~ https://www.tandfonline.com/doi/pdf/10.1080/15459620903120086

10. H Jung, J Kim, et al. Comparison of filtration efficiency and pressure drop in anti-yellow sand masks, quarantine masks, medical masks, general masks, and handkerchiefs. Aerosol Air Qual Res. 2013 Jun. 14:991-1002. ~~ https://aaqr.org/articles/aaqr-13-06-oa-0201.pdf

11. C MacIntyre, H Seale, et al. A cluster randomized trial of cloth masks compared with medical masks in healthcare workers. BMJ Open. 2015; 5(4) ~~ https://bmjopen.bmj.com/content/5/4/e006577.long

12. N95 masks explained. ~~ https://www.honeywell.com/en-us/newsroom/news/2020/03/n95-masks-explained

13. V Offeddu, C Yung, et al. Effectiveness of masks and respirators against infections in healthcare workers: A systematic review and meta-analysis. Clin Inf Dis. 65(11), 2017 Dec 1; 1934-1942. ~~ https://academic.oup.com/cid/article/65/11/1934/4068747

14. C MacIntyre, Q Wang, et al. A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. Influenza J. 2010 Dec 3. ~~ https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1750-2659.2011.00198.x?fbclid=IwAR3kRYVYDKb0aR-su9_me9_vY6a8KVR4HZ17J2A_80f_fXUABRQdhQlc8Wo

15. M Walker. Study casts doubt on N95 masks for the public. MedPage Today. 2020 May 20. ~~ https://www.medpagetoday.com/infectiousdisease/publichealth/86601

16. C MacIntyre, Q Wang, et al. A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. Influenza J. 2010 Dec 3. ~~ https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1750-2659.2011.00198.x?fbclid=IwAR3kRYVYDKb0aR-su9_me9_vY6a8KVR4HZ17J2A_80f_fXUABRQdhQlc8Wo

17. N Shimasaki, A Okaue, et al. Comparison of the filter efficiency of medical nonwoven fabrics against three different microbe aerosols. Biocontrol Sci. 2018; 23(2). 61-69. ~~ https://www.jstage.jst.go.jp/article/bio/23/2/23_61/_pdf/-char/en

18. T Tunevall. Postoperative wound infections and surgical face masks: A controlled study. World J Surg. 1991 May; 15: 383-387. ~~ https://link.springer.com/article/10.1007%2FBF01658736

19. N Orr. Is a mask necessary in the operating theatre? Ann Royal Coll Surg Eng 1981: 63: 390-392. ~~ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2493952/pdf/annrcse01509-0009.pdf --- 20 N Mitchell, S Hunt. Surgical face masks in modern operating rooms – a costly and unnecessary ritual? J Hosp Infection. 18(3); 1991 Jul 1. 239-242. ~~ https://www.journalofhospitalinfection.com/article/0195-6701(91)90148-2/pdf

20. C DaZhou, P Sivathondan, et al. Unmasking the surgeons: the evidence base behind the use of facemasks in surgery. JR Soc Med. 2015 Jun; 108(6): 223-228 ~~ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4480558/

21. L Brosseau, M Sietsema. Commentary: Masks for all for Covid-19 not based on sound data. U Minn Ctr Inf Dis Res Pol. 2020 Apr 1. ~~ https://www.cidrap.umn.edu/news-perspective/2020/04/commentary-masks-all-covid-19-not-based-sound-data

22. N Leung, D Chu, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks Nature Research. 2020 Mar 7. 26,676-680 (2020). ~~ https://www.researchsquare.com/article/rs-16836/v1

23. S Rengasamy, B Eimer, et al. Simple respiratory protection – evaluation of the filtration performance of cloth masks and common fabric materials against 20-1000 nm size particles. Ann Occup Hyg. 2010 Oct; 54(7): 789-798. ~~ https://academic.oup.com/annweh/article/54/7/789/202744

24. S Bae, M Kim, et al. Effectiveness of surgical and cotton masks in blocking SARS-CoV-2: A controlled comparison in 4 patients. Ann Int Med. 2020 Apr 6. ~~ https://www.acpjournals.org/doi/10.7326/M20-1342

25. S Rengasamy, B Eimer, et al. Simple respiratory protection – evaluation of the filtration performance of cloth masks and common fabric materials against 20-1000 nm size particles. Ann Occup Hyg. 2010 Oct; 54(7): 789-798. ~~ https://academic.oup.com/annweh/article/54/7/789/202744

26. C MacIntyre, H Seale, et al. A cluster randomized trial of cloth masks compared with medical masks in healthcare workers. BMJ Open. 2015; 5(4) ~~ https://bmjopen.bmj.com/content/5/4/e006577.long

27. W Kellogg. An experimental study of the efficacy of gauze face masks. Am J Pub Health. 1920. 34-42. ~~ https://ajph.aphapublications.org/doi/pdf/10.2105/AJPH.10.1.34

28. M Klompas, C Morris, et al. Universal masking in hospitals in the Covid-19 era. N Eng J Med. 2020; 382 e63. ~~ https://www.nejm.org/doi/full/10.1056/NEJMp2006372

29. E Person, C Lemercier et al. Effect of a surgical mask on six-minute walking distance. Rev Mal Respir. 2018 Mar; 35(3):264-268. ~~ https://pubmed.ncbi.nlm.nih.gov/29395560/

30. B Chandrasekaran, S Fernandes. Exercise with facemask; are we handling a devil's sword – a physiological hypothesis. Med Hypothese. 2020 Jun 22. 144:110002. x ~~ https://pubmed.ncbi.nlm.nih.gov/32590322/

31. P Shuang Ye Tong, A Sugam Kale, et al. Respiratory consequences of N95-type mask usage in pregnant healthcare workers – A controlled clinical study. Antimicrob Resist Infect Control. 2015 Nov 16; 4:48. ~~ https://pubmed.ncbi.nlm.nih.gov/26579222/

32. T Kao, K Huang, et al. The physiological impact of wearing an N95 mask during hemodialysis as a precaution against SARS in patients with end-stage renal disease. J Formos Med Assoc. 2004 Aug; 103(8):624-628. ~~ https://pubmed.ncbi.nlm.nih.gov/15340662/

33. F Blachere, W Lindsley et al. Assessment of influenza virus exposure and recovery from contaminated surgical masks and N95 respirators. J Viro Methods. 2018 Oct; 260:98-106. ~~ https://pubmed.ncbi.nlm.nih.gov/30029810/

34. A Rule, O Apau, et al. Healthcare personnel exposure in an emergency department during influenza season. PLoS One. 2018 Aug 31; 13(8): e0203223. ~~ https://pubmed.ncbi.nlm.nih.gov/30169507/

35. F Blachere, W Lindsley et al. Assessment of influenza virus exposure and recovery from contaminated surgical masks and N95 respirators. J Viro Methods. 2018 Oct; 260:98-106. ~~ https://pubmed.ncbi.nlm.nih.gov/30029810/

36. A Chughtai, S Stelzer-Braid, et al. Contamination by respiratory viruses on our surface of medical masks used by hospital healthcare workers. BMC Infect Dis. 2019 Jun 3; 19(1): 491. ~~ https://pubmed.ncbi.nlm.nih.gov/31159777/

37. L Zhiqing, C Yongyun, et al. J Orthop Translat. 2018 Jun 27; 14:57-62. ~~ https://pubmed.ncbi.nlm.nih.gov/30035033/
38. C MacIntyre, H Seale, et al. A cluster randomized trial of cloth masks compared with medical masks in healthcare workers. BMJ Open. 2015; 5(4) ~~ https://bmjopen.bmj.com/content/5/4/e006577
39. A Beder, U Buyukkocak, et al. Preliminary report on surgical mask induced deoxygenation during major surgery. Neurocirugia. 2008; 19: 121-126. ~~ http://scielo.isciii.es/pdf/neuro/v19n2/3.pdf
40. D Lukashev, B Klebanov, et al. Cutting edge: Hypoxia-inducible factor 1-alpha and its activation-inducible short isoform negatively regulate functions of CD4+ and CD8+ T lymphocytes. J Immunol. 2006 Oct 15; 177(8) 4962-4965. ~~ https://www.jimmunol.org/content/177/8/4962
41. A Sant, A McMichael. Revealing the role of CD4+ T-cells in viral immunity. J Exper Med. 2012 Jun 30; 209(8):1391-1395

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Review of the Medical Literature

42. Here are key anchor points to the extensive scientific literature that establishes that wearing surgical masks and respirators (e.g., "N95") does not reduce the risk of contracting a verified illness:

43. **Jacobs, J. L. et al. (2009)** "Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: A randomized controlled trial," *American Journal of Infection Control*, Volume 37, Issue 5, 417 – 419. https://www.ncbi.nlm.nih.gov/pubmed/19216002

44. N95-masked health-care workers (HCW) were significantly more likely to experience headaches. Face mask use in HCW was not demonstrated to provide benefit in terms of cold symptoms or getting colds.

45. **Cowling, B. et al. (2010)** "Face masks to prevent transmission of influenza virus: A systematic review," *Epidemiology and Infection*, 138(4), 449-456. https://www.cambridge.org/core/journals/epidemiology-and-infection/article/face-masks-to-prevent-transmission-of-influenza-virus-a-systematic-review/64D368496EBDE0AFCC6639CCC9D8BC05

46. None of the studies reviewed showed a benefit from wearing a mask, in either HCW or community members in households (H). See summary Tables 1 and 2 therein.

47. **bin-Reza et al. (2012)** "The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence," *Influenza and Other Respiratory Viruses* 6(4), 257– 267. https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1750-2659.2011.00307.x

48. "There were 17 eligible studies. … **None of the studies established a conclusive relationship between mask/respirator use and protection against influenza infection**."

49. **Smith, J.D. et al. (2016)** "Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis," *CMAJ* Mar 2016 https://www.cmaj.ca/content/188/8/567

50. "We identified six clinical studies … . In the meta-analysis of the clinical studies, we found no significant difference between N95 respirators and surgical masks in associated risk of (a) laboratory-confirmed respiratory infection, (b) influenza-like illness, or (c) reported work-place absenteeism."

51. **Offeddu, V. et al. (2017)** "Effectiveness of Masks and Respirators Against Respiratory Infections in Healthcare Workers: A Systematic Review and Meta-Analysis," *Clinical Infectious Diseases*, Volume 65, Issue 11, 1 December 2017, Pages 1934–1942, https://academic.oup.com/cid/article/65/11/1934/4068747

52. "Self-reported assessment of clinical outcomes was prone to bias. Evidence of a protective effect of masks or respirators against verified respiratory infection (VRI) was not statistically significant"; as per Fig. 2c therein:

53. **Radonovich, L.J. et al. (2019)** "N95 Respirators vs Medical Masks for Preventing Influenza Among Health Care Personnel: A Randomized Clinical Trial," *JAMA*. 2019; 322(9): 824–833. https://jamanetwork.com/journals/jama/fullarticle/2749214

54. "Among 2862 randomized participants, 2371 completed the study and accounted for 5180 HCW-seasons. … Among outpatient health care personnel, N95 respirators vs medical masks as worn by participants in this trial resulted in no significant difference in the incidence of laboratory-confirmed influenza."

55. **Long, Y. et al. (2020)** "Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis," *J Evid Based Med*. 2020; 1-9. https://onlinelibrary.wiley.com/doi/epdf/10.1111/jebm.12381

56. "A total of six RCTs involving 9,171 participants were included. There were no statistically significant differences in preventing laboratory-confirmed influenza, laboratory-confirmed respiratory viral infections, laboratory-confirmed respiratory infection, and influenza-like illness using N95 respirators and surgical masks. Meta-analysis indicated a protective effect of N95 respirators against laboratory-confirmed bacterial colonization (RR = 0.58, 95% CI 0.43-0.78). The use of N95 respirators compared with surgical masks is not associated with a lower risk of laboratory-confirmed influenza."

57. **Conclusion Regarding That Masks Do Not Work**

58. No RCT study with verified outcome shows a benefit for HCW or community members in households to wearing a mask or respirator. There is no such study. There are no exceptions.

59. Likewise, no study exists that shows a benefit from a broad policy to wear masks in public (more on this below).

60. Furthermore, if there were any benefit to wearing a mask, because of the blocking power against droplets and aerosol particles, then there should be more benefit from wearing a respirator (N95) compared to a surgical mask, yet several large meta-analyses, and all the RCT, prove that there is no such relative benefit.

61. Masks and respirators do not work. https://www.rcreader.com/commentary/masks-dont-work-covid-a-review-of-science-relevant-to-covide-19-social-policy

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New Danish Study - https://www.acpjournals.org/doi/10.7326/M20-6817

62. Stanford Study - The existing scientific evidences challenge the safety and efficacy of wearing facemask as preventive intervention for COVID-19. The data suggest that both medical and non-medical facemasks are ineffective to block human-to-human transmission of viral and infectious disease such SARS-CoV-2 and COVID-19, supporting against the usage of facemasks. https://www.sciencedirect.com/science/article/pii/S0306987720333028#b0280 This link has been redacted https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7680614/

63. SECOND STUDY This Time from CDC WEBSITE Confirms Stanford Study on Face Masks Being Harmful – Cause Serious Side Effects https://www.thegatewaypundit.com/2021/04/stanford-study-noting-ineffectiveness-harm-masks-censored-twitter-now-second-study-published-cdcs-website-confirms-masks-cause-serious-side-effects/?utm_source=Email&utm_medium=the-gateway-pundit&utm_campaign=dailypm&utm_content=daily

64. Predominant Role of Bacterial Pneumonia as a Cause of Death in Pandemic Influenza: Implications for Pandemic Influenza Preparedness https://academic.oup.com/jid/article/198/7/962/2192118

Masks Don't Work: A review of science relevant to COVID-19 social policy

Technical Report · April 2020

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143 PUBLICATIONS   **4,233** CITATIONS

Some of the authors of this publication are also working on these related projects:

Free Mössbauer Spectroscopy Software: Recoil for Windows View project

Science reviews relevant to COVID-19 View project

Masks Don't Work

A review of science relevant to COVID-19 social policy

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Researcher, Ontario Civil Liberties Association (ocla.ca)

April 2020

Summary / Abstract

Masks and respirators do not work.

There have been extensive randomized controlled trial (RCT) studies, and meta-analysis reviews of RCT studies, which all show that masks and respirators do not work to prevent respiratory influenza-like illnesses, or respiratory illnesses believed to be transmitted by droplets and aerosol particles.

Furthermore, the relevant known physics and biology, which I review, are such that masks and respirators should not work. It would be a paradox if masks and respirators worked, given what we know about viral respiratory diseases: The main transmission path is long-residence-time aerosol particles (< 2.5 μm), which are too fine to be blocked, and the minimum-infective-dose is smaller than one aerosol particle.

The present paper about masks illustrates the degree to which governments, the mainstream media, and institutional propagandists can decide to operate in a science vacuum, or select only incomplete science that serves their interests. Such recklessness is also certainly the case with the current global lockdown of over 1 billion people, an unprecedented experiment in medical and political history.

Review of the Medical Literature

Here are key anchor points to the extensive scientific literature that establishes that wearing surgical masks and respirators (e.g., "N95") does not reduce the risk of contracting a verified illness:

Jacobs, J. L. et al. (2009) "Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: A randomized controlled trial", *American Journal of Infection Control*, Volume 37, Issue 5, 417 - 419.
https://www.ncbi.nlm.nih.gov/pubmed/19216002
> N95-masked health-care workers (HCW) were significantly more likely to experience headaches. Face mask use in HCW was not demonstrated to provide benefit in terms of cold symptoms or getting colds.

Cowling, B. et al. (2010) "Face masks to prevent transmission of influenza virus: A systematic review", *Epidemiology and Infection*, 138(4), 449-456.
doi:10.1017/S0950268809991658
https://www.cambridge.org/core/journals/epidemiology-and-infection/article/face-masks-to-prevent-transmission-of-influenza-virus-a-systematic-review/64D368496EBDE0AFCC6639CCC9D8BC05
> None of the studies reviewed showed a benefit from wearing a mask, in either HCW or community members in households (H). See summary Tables 1 and 2 therein.

bin-Reza et al. (2012) "The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence", *Influenza and Other Respiratory Viruses* 6(4), 257–267.
https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1750-2659.2011.00307.x
> "There were 17 eligible studies. … None of the studies established a conclusive relationship between mask ∕ respirator use and protection against influenza infection."

Smith, J.D. et al. (2016) "Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis", *CMAJ* Mar 2016, cmaj.150835; DOI: 10.1503/cmaj.150835
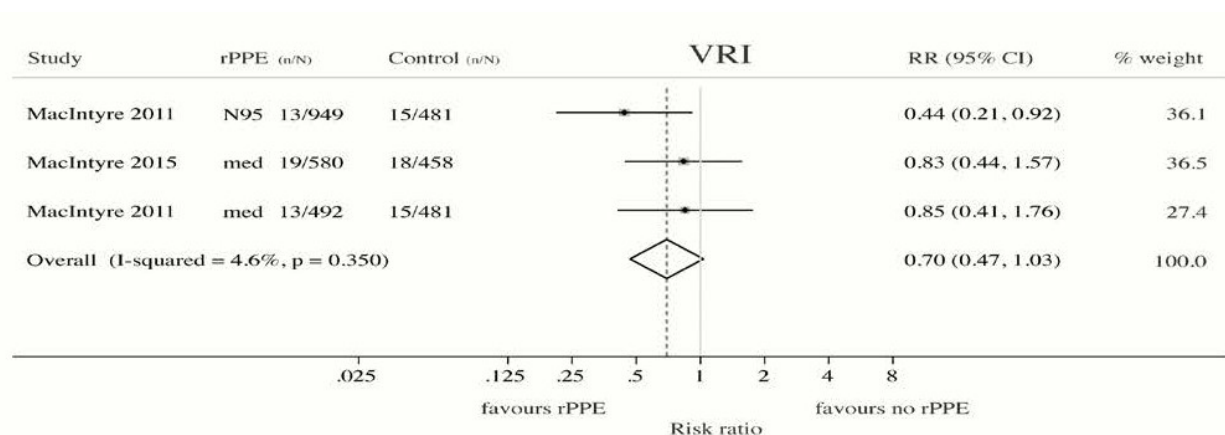https://www.cmaj.ca/content/188/8/567
> "We identified 6 clinical studies ... In the meta-analysis of the clinical studies, we found no significant difference between N95 respirators and surgical masks in associated risk of (a) laboratory-confirmed respiratory infection, (b) influenza-like illness, or (c) reported work-place absenteeism."

Offeddu, V. et al. (2017) "Effectiveness of Masks and Respirators Against Respiratory Infections in Healthcare Workers: A Systematic Review and Meta-Analysis", *Clinical Infectious Diseases*, Volume 65, Issue 11, 1 December 2017, Pages 1934–1942, https://doi.org/10.1093/cid/cix681
https://academic.oup.com/cid/article/65/11/1934/4068747

"Self-reported assessment of clinical outcomes was prone to bias. Evidence of a protective effect of masks or respirators against verified respiratory infection (VRI) was not statistically significant"; as per Fig. 2c therein:

Radonovich, L.J. et al. (2019) "N95 Respirators vs Medical Masks for Preventing Influenza Among Health Care Personnel: A Randomized Clinical Trial", *JAMA*. 2019; 322(9): 824–833. doi:10.1001/jama.2019.11645
https://jamanetwork.com/journals/jama/fullarticle/2749214

"Among 2862 randomized participants, 2371 completed the study and accounted for 5180 HCW-seasons. … Among outpatient health care personnel, N95 respirators vs medical masks as worn by participants in this trial resulted in no significant difference in the incidence of laboratory-confirmed influenza."

Long, Y. et al. (2020) "Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis", *J Evid Based Med.* 2020; 1- 9. https://doi.org/10.1111/jebm.12381
https://onlinelibrary.wiley.com/doi/epdf/10.1111/jebm.12381

"A total of six RCTs involving 9 171 participants were included. There were no statistically significant differences in preventing laboratory-confirmed influenza, laboratory-confirmed respiratory viral infections, laboratory-confirmed respiratory infection and influenza-like illness using N95 respirators and surgical masks. Meta-analysis indicated a protective effect of N95 respirators against laboratory-confirmed bacterial colonization (RR = 0.58, 95% CI 0.43-0.78). The

use of N95 respirators compared with surgical masks is not associated with a lower risk of laboratory-confirmed influenza."

Conclusion Regarding that Masks Do Not Work

No RCT study with verified outcome shows a benefit for HCW or community members in households to wearing a mask or respirator. There is no such study. There are no exceptions.

Likewise, no study exists that shows a benefit from a broad policy to wear masks in public (more on this below).

Furthermore, if there were any benefit to wearing a mask, because of the blocking power against droplets and aerosol particles, then there should be more benefit from wearing a respirator (N95) compared to a surgical mask, yet several large meta-analyses, and all the RCT, prove that there is no such relative benefit.

Masks and respirators do not work.

Precautionary Principle Turned on Its Head with Masks

In light of the medical research, therefore, it is difficult to understand why public-health authorities are not consistently adamant about this established scientific result, since the distributed psychological, economic and environmental harm from a broad recommendation to wear masks is significant, not to mention the unknown potential harm from concentration and distribution of pathogens on and from used masks. In this case, public authorities would be turning the precautionary principle on its head (see below).

Physics and Biology of Viral Respiratory Disease and of Why Masks Do Not Work

In order to understand why masks cannot possibly work, we must review established knowledge about viral respiratory diseases, the mechanism of seasonal variation of excess deaths from pneumonia and influenza, the aerosol mechanism of infectious disease transmission, the physics and chemistry of aerosols, and the mechanism of the so-called minimum-infective-dose.

In addition to pandemics that can occur anytime, in the temperate latitudes there is an extra burden of respiratory-disease mortality that is seasonal, and that is caused by viruses. For

example, see the review of influenza by Paules and Subbarao (2017). This has been known for a long time, and the seasonal pattern is exceedingly regular.

For example, see Figure 1 of Viboud (2010), which has "Weekly time series of the ratio of deaths from pneumonia and influenza to all deaths, based on the 122 cities surveillance in the US (blue line). The red line represents the expected baseline ratio in the absence of influenza activity," here:
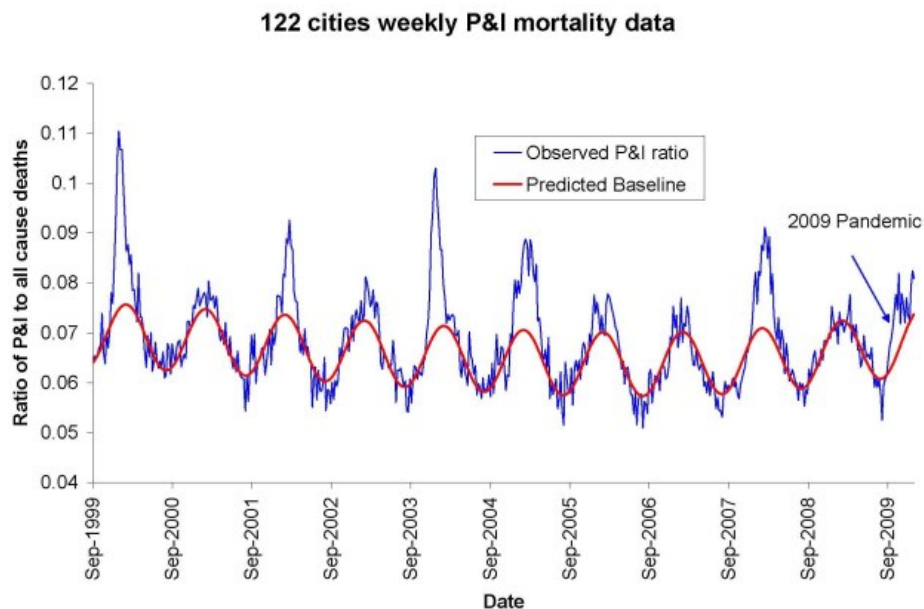
The seasonality of the phenomenon was largely not understood until a decade ago. Until recently, it was debated whether the pattern arose primarily because of seasonal change in virulence of the pathogens, or because of seasonal change in susceptibility of the host (such as from dry air causing tissue irritation, or diminished daylight causing vitamin deficiency or hormonal stress). For example, see Dowell (2001).

In a landmark study, Shaman et al. (2010) showed that the seasonal pattern of extra respiratory-disease mortality can be explained quantitatively on the sole basis of absolute humidity, and its direct controlling impact on transmission of airborne pathogens.

Lowen et al. (2007) demonstrated the phenomenon of humidity-dependent airborne-virus virulence in actual disease transmission between guinea pigs, and discussed potential underlying mechanisms for the measured controlling effect of humidity.

The underlying mechanism is that the pathogen-laden aerosol particles or droplets are neutralized within a half-life that monotonically and significantly decreases with increasing ambient humidity. This is based on the seminal work of Harper (1961). Harper experimentally showed that viral-pathogen-carrying droplets were inactivated within shorter and shorter times, as ambient humidity was increased.

Harper argued that the viruses themselves were made inoperative by the humidity ("viable decay"), however, he admitted that the effect could be from humidity-enhanced physical removal or sedimentation of the droplets ("physical loss"): "Aerosol viabilities reported in this paper are based on the ratio of virus titre to radioactive count in suspension and cloud samples, and can be criticized on the ground that test and tracer materials were not physically identical."

The latter ("physical loss") seems more plausible to me, since humidity would have a universal physical effect of causing particle / droplet growth and sedimentation, and all tested viral pathogens have essentially the same humidity-driven "decay". Furthermore, it is difficult to understand how a virion (of all virus types) in a droplet would be molecularly or structurally attacked or damaged by an increase in ambient humidity. A "virion" is the complete, infective form of a virus outside a host cell, with a core of RNA or DNA and a capsid. The actual mechanism of such humidity-driven intra-droplet "viable decay" of a virion has not been explained or studied.

In any case, the explanation and model of Shaman et al. (2010) is not dependant on the particular mechanism of the humidity-driven decay of virions in aerosol / droplets. Shaman's quantitatively demonstrated model of seasonal regional viral epidemiology is valid for either mechanism (or combination of mechanisms), whether "viable decay" or "physical loss".

The breakthrough achieved by Shaman et al. is not merely some academic point. Rather, it has profound health-policy implications, which have been entirely ignored or overlooked in the current coronavirus pandemic.

In particular, Shaman's work necessarily implies that, rather than being a fixed number (dependent solely on the spatial-temporal structure of social interactions in a completely susceptible population, and on the viral strain), the epidemic's **basic reproduction number** (R0) is highly or predominantly dependent on ambient absolute humidity.

For a definition of R0, see HealthKnowlege-UK (2020): R0 is "the average number of secondary infections produced by a typical case of an infection in a population where everyone is susceptible." The average R0 for influenza is said to be 1.28 (1.19–1.37); see the comprehensive review by Biggerstaff et al. (2014).

In fact, Shaman et al. showed that R0 must be understood to seasonally vary between humid-summer values of just larger than "1" and dry-winter values typically as large as "4" (for example, see their Table 2). In other words, the seasonal infectious viral respiratory diseases that plague temperate latitudes every year go from being intrinsically mildly contagious to

virulently contagious, due simply to the bio-physical mode of transmission controlled by atmospheric humidity, irrespective of any other consideration.

Therefore, all the epidemiological mathematical modelling of the benefits of mediating policies (such as social distancing), which assumes humidity-independent R0 values, has a large likelihood of being of little value, on this basis alone. For studies about modelling and regarding mediation effects on the effective reproduction number, see Coburn (2009) and Tracht (2010).

To put it simply, the "second wave" of an epidemic is not a consequence of human sin regarding mask wearing and hand shaking. Rather, the "second wave" is an inescapable consequence of an air-dryness-driven many-fold increase in disease contagiousness, in a population that has not yet attained immunity.

If my view of the mechanism is correct (i.e., "physical loss"), then Shaman's work further necessarily implies that the dryness-driven high transmissibility (large R0) arises from small aerosol particles fluidly suspended in the air; as opposed to large droplets that are quickly gravitationally removed from the air.

Such small aerosol particles fluidly suspended in air, of biological origin, are of every variety and are everywhere, including down to virion-sizes (Despres, 2012). It is not entirely unlikely that viruses can thereby be physically transported over inter-continental distances (e.g., Hammond, 1989).

More to the point, indoor airborne virus concentrations have been shown to exist (in day-care facilities, health centres, and onboard airplanes) primarily as aerosol particles of diameters smaller than 2.5 μm, such as in the work of Yang et al. (2011):

> "Half of the 16 samples were positive, and their total virus concentrations ranged from 5800 to 37 000 genome copies m^{-3}. On average, 64 per cent of the viral genome copies were associated with fine particles smaller than 2.5 μm, which can remain suspended for hours. Modelling of virus concentrations indoors suggested a source strength of $1.6 \pm 1.2 \times 10^5$ genome copies m^{-3} air h^{-1} and a deposition flux onto surfaces of 13 ± 7 genome copies m^{-2} h^{-1} by Brownian motion. Over 1 hour, the inhalation dose was estimated to be 30 ± 18 median tissue culture infectious dose ($TCID_{50}$), adequate to induce infection. These results provide quantitative support for the idea that the aerosol route could be an important mode of influenza transmission."

Such small particles (< 2.5 μm) are part of air fluidity, are not subject to gravitational sedimentation, and would not be stopped by long-range inertial impact. This means that the slightest (even momentary) facial misfit of a mask or respirator renders the design filtration norm of the mask or respirator entirely irrelevant. In any case, the filtration material itself of

N95 (average pore size ~0.3–0.5 μm) does not block virion penetration, not to mention surgical masks. For example, see Balazy et al. (2006).

Mask stoppage efficiency and host inhalation are only half of the equation, however, because the minimal infective dose (MID) must also be considered. For example, if a large number of pathogen-laden particles must be delivered to the lung within a certain time for the illness to take hold, then partial blocking by any mask or cloth can be enough to make a significant difference.

On the other hand, if the MID is amply surpassed by the virions carried in a single aerosol particle able to evade mask-capture, then the mask is of no practical utility, which is the case.

Yezli and Otter (2011), in their review of the MID, point out relevant features:

- most respiratory viruses are as infective in humans as in tissue culture having optimal laboratory susceptibility
- it is believed that a single virion can be enough to induce illness in the host
- the 50%-probability MID ("TCID$_{50}$") has variably been found to be in the range 100–1000 virions
- there are typically 10^3–10^7 virions per aerolized influenza droplet with diameter 1 μm – 10 μm
- the 50%-probability MID easily fits into a single (one) aerolized droplet

For further background:

- A classic description of dose-response assessment is provided by Haas (1993).
- Zwart et al. (2009) provided the first laboratory proof, in a virus-insect system, that the action of a single virion can be sufficient to cause disease.
- Baccam et al. (2006) calculated from empirical data that, with influenza A in humans, "we estimate that after a delay of ~6 h, infected cells begin producing influenza virus and continue to do so for ~5 h. The average lifetime of infected cells is ~11 h, and the half-life of free infectious virus is ~3 h. We calculated the [in-body] basic reproductive number, R_0, which indicated that a single infected cell could produce ~22 new productive infections."
- Brooke et al. (2013) showed that, contrary to prior modeling assumptions, although not all influenza-A-infected cells in the human body produce infectious progeny (virions), nonetheless, 90% of infected cell are significantly impacted, rather than simply surviving unharmed.

All of this to say that: if anything gets through (and it always does, irrespective of the mask), then you are going to be infected. Masks cannot possibly work. It is not surprising, therefore, that no bias-free study has ever found a benefit from wearing a mask or respirator in this application.

Therefore, the studies that show partial stopping power of masks, or that show that masks can capture many large droplets produced by a sneezing or coughing mask-wearer, in light of the above-described features of the problem, are irrelevant. For example, such studies as these: Leung (2020), Davies (2013), Lai (2012), and Sande (2008).

Why There Can Never Be an Empirical Test of a Nation-Wide Mask-Wearing Policy

As mentioned above, no study exists that shows a benefit from a broad policy to wear masks in public. There is good reason for this. It would be impossible to obtain unambiguous and bias-free results:

- Any benefit from mask-wearing would have to be a small effect, since undetected in controlled experiments, which would be swamped by the larger effects, notably the large effect from changing atmospheric humidity.
- Mask compliance and mask adjustment habits would be unknown.
- Mask-wearing is associated (correlated) with several other health behaviours; see Wada (2012).
- The results would not be transferable, because of differing cultural habits.
- Compliance is achieved by fear, and individuals can habituate to fear-based propaganda, and can have disparate basic responses.
- Monitoring and compliance measurement are near-impossible, and subject to large errors.
- Self-reporting (such as in surveys) is notoriously biased, because individuals have the self-interested belief that their efforts are useful.
- Progression of the epidemic is not verified with reliable tests on large population samples, and generally relies on non-representative hospital visits or admissions.
- Several different pathogens (viruses and strains of viruses) causing respiratory illness generally act together, in the same population and/or in individuals, and are not resolved, while having different epidemiological characteristics.

Unknown Aspects of Mask Wearing

Many potential harms may arise from broad public policies to wear masks, and the following unanswered questions arise:

- Do used and loaded masks become sources of enhanced transmission, for the wearer and others?

- Do masks become collectors and retainers of pathogens that the mask wearer would otherwise avoid when breathing without a mask?
- Are large droplets captured by a mask atomized or aerolized into breathable components? Can virions escape an evaporating droplet stuck to a mask fiber?
- What are the dangers of bacterial growth on a used and loaded mask?
- How do pathogen-laden droplets interact with environmental dust and aerosols captured on the mask?
- What are long-term health effects on HCW, such as headaches, arising from impeded breathing?
- Are there negative social consequences to a masked society?
- Are there negative psychological consequences to wearing a mask, as a fear-based behavioural modification?
- What are the environmental consequences of mask manufacturing and disposal?
- Do the masks shed fibres or substances that are harmful when inhaled?

Conclusion

By making mask-wearing recommendations and policies for the general public, or by expressly condoning the practice, governments have both ignored the scientific evidence and done the opposite of following the precautionary principle.

In an absence of knowledge, governments should not make policies that have a hypothetical potential to cause harm. The government has an onus barrier before it instigates a broad social-engineering intervention, or allows corporations to exploit fear-based sentiments.

Furthermore, individuals should know that there is no known benefit arising from wearing a mask in a viral respiratory illness epidemic, and that scientific studies have shown that any benefit must be residually small, compared to other and determinative factors.

Otherwise, what is the point of publicly funded science?

The present paper about masks illustrates the degree to which governments, the mainstream media, and institutional propagandists can decide to operate in a science vacuum, or select only incomplete science that serves their interests. Such recklessness is also certainly the case with the current global lockdown of over 1 billion people, an unprecedented experiment in medical and political history.

Endnotes:

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For Department's response and please copy the Premier.

Thank you,

Sheri Forsythe

Correspondence Coordinator / Coordinatrice de la correspondance

Office of the Premier/Cabinet du premier ministre

From: 21(1)
Sent: Monday, April 4, 2022 1:37 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Please read - Don't reinstate mask mandate in schools

Dear Premier Higgs,

I'm writing to you in contrast to the email that is rumored you've received from a group of New Brunswickers asking you to bring back forced masking on children in schools.

As a teacher who has watched this all playout for the past 3 school years, I beg you not to reinstate this mandate. We have no idea yet of the damages we have caused children with these mandates and many of the psychological impacts won't be fully

realized for years to come. What I can tell you from my own 4th grade classroom is that over the last 2 weeks of not having forced masks, my students have come alive again. They have told me countless times about how much happier they are to be at school. You can see this in their eyes, their smiles, even their effort toward their work. It's the most normal they have had for 3 school years. This matters! Please let them finish off the last three months with some normalcy.

I know those on the other side of this debate are simply louder, but please don't take our quieter approach as nonexistent. I need you to know there are MANY of us out here, teachers, students and parents who don't want forced masking to return. There are MANY of us who see the benefits of personal choice when it comes to masking and see the damages mandates have already caused. In my opinion, these damages far outweigh any benefit that we may have one time believed masks provided. We believe in people's ability to personally provide their own risk assessment when it comes to germs and don't require the government to do that for us.

The pandemic has definitely highlighted our broken systems in the province but many of these issues have been here all along and will not be fixed my a cloth mask.

Mr. Higgs, please don't let the loud voices dictate the decisions of the province.

Thank you,

21(1)

From: 21(1)
To: Higgs, Premier Blaine (PO/CPM) [Blaine.Higgs@gnb.ca]
Subject: What do the 36 pediatricians who did not sign think?
Date: Monday, April 04, 2022 10:37:50

_____

ATTENTION! External email / courriel externe.

Why does nobody care about kids who suffer negative effects from masking?

Your mandates hurt people, understand that.

From:	Higgs, Premier Blaine (PO/CPM) []
To:	EECD Correspondence (EECD/EDPE) [EECD.Correspondence@gnb.ca]
Subject:	FW: Against masks in school
Date:	Thursday, March 31, 2022 13:07:47

_____

Will leave for EECD to respond (if they decide)

Sheri

From: 21(1) ███████████████████████████
Sent: Wednesday, March 30, 2022 7:42 AM
To: Allain, Daniel Hon. (ELG/EGL) <Daniel.Allain@gnb.ca>; Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>; Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>
Subject: Against masks in school

ATTENTION! External email / courriel externe.

Good morning,

I just wanted to make a strong stance AGAINST the return of masks in schools at this time.

Our kids have gone through enough in the past 2 years. They have been resilient and have been so strong but the constant changing of rules has been hard for them. I personally have seen how these constants changing of rules has affected my 9-year-old mental health. She is not the kid she should be at this age, which breaks my heart. The ups and down of these constant changes is hard on them and us as parents to keep explaining these changes even when we don't agree with them. I know life is hard and they need to learn but lets try to make the rest of this school year as normal as can be.

Not much has changed since the masking rules were taken out of the schools. The cases are not higher in school kids than they are in other age groups. I don't see the need to change the rule at this time. We made a family decision like all the other

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families in our school. It's a personal decision and from what my daughter has told me any decision is being respected. And lets be clear masks in school are not the best solutions if you have ever been on school grounds since the pandemic, they are not worn properly most of the time.

Let us parent our kids and allow us to make the decision we feel is best for the physical and mental health of our kids.

Ps If the decision is made to mask our kids again it will need to apply to teachers as well. I will NOT mask my kid if the teachers have a free pass on this issue.

Thank you,

21(1)

Get Outlook for iOS

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Leaving this with EECD for response.

Sheri

From: 21(1) ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓
Sent: Wednesday, March 30, 2022 10:47 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>; Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>
Subject: Masking in Schools

ATTENTION! External email / courriel externe.

Premier Higgs and Minister Cardy,

I am very concerned about the suggestion that masks may be reinstated in schools. After months of my child, who is only in Kindergarden, crying every day before school that he hates it and doesn't want to go, we finally have a reprieve. Since removing masking, my child is excited to go to school, every day. He's happy every day when he leaves. This should be the precedent set in the early years if we want our children to love learning, and to be successful in school and in life. These are directly related, and we have the responsibility to set them up for success. These masks were affecting their mental health and we need to better take care of our kids, of all ages. They deserve better.

We, as adults, have a responsibility to ensure that our households are acting responsibly. I was recently sick; my son was not, but wore a mask to school during that time anyway. When my neighbours were sick, I worked from home home so my son did not need to wait for the bus with them. This is common sense and common courtesy.

I am imploring you not to allow the reinstatement of masks in schools; please trust that people will do the right thing. Our kids can finally be happy, they deserve to be happy, and they deserve to finish this year on a positive note.

Regards,

21(1)

From:	Higgs, Premier Blaine (PO/CPM) []
To:	EECD Correspondence (EECD/EDPE) [EECD.Correspondence@gnb.ca]
Subject:	FW: Masks @ School
Date:	Wednesday, March 30, 2022 10:41:22

_____

Good Morning,

Leaving this with EECD for response and copy Premier.

Thank you,

Sheri Forsythe

Correspondence Coordinator/Coordinatrice de la correspondance

Office of the Premier/Cabinet du premier ministre

From: 21(1) ███████████████████████████
Sent: Wednesday, March 30, 2022 9:26 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>; Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>; Austin, Kris (LEG) <Kris.Austin@gnb.ca>
Subject: Masks @ School

ATTENTION! External email / courriel externe.

Mr. Higgs & Mr. Cardy,

I am writing today as I see Mr. Higgs you are cowering to the minority pressure of those who again want to mask our children!!!

I am so tired of the back and forth agendas you both are promoting. How about after two years into this pandemic we move on and let people decide their own health risks. For two years we've heard leaders say "get the vaccine so you won't get covid" (there are lots of videos out there to prove this statement), then it was oh the vaccine(x2) will make sure your symptoms are mild, now get boosted to keep you safe..and get vaccinated so you won't have to mask and then vaccinated and mask.confused yet?

I certainly am!!!

My child was so excited to return to school without the mask and has been so much happier. The atmosphere in my child's school has been happier, children on the bus are smiling and at school. From our experience at my child's school - 85% or more of the school is NOT Wearing Masks!! So tell me why you are going to give in AGAIN to a minority of people!

Maybe the other side of the coin will happen. Maybe I'll keep my child home if they have to go back to masks.

My child has struggled with breathing, concentration and many other things because of the mask. It is NOT helping and has never helped!!

If masks work so well why have most of our infections and cases been when we were masked and basically locked down in the last few months???

We are also in flu season so maybe we need to take a step back and consider this.

You have given people the tools to stay safe, so how about we trust the tools or trust the "science" as you all say and let people live. Our children's education has suffered - my child's teacher had to re-teach some Math this semester because the students didn't get what they were supposed to get over the last two years!!

My child has been vaccinated and if what you say is true they should be able to live life!

Also, you may say what about the children not vaccinated- well your science again has proven that children are the least at risk!!!

Also, I do remember not that long ago that your own Dr. Russell said that Cloth Masks don't work and was promoting N95 masks - so is this what you are suggesting for all the children for school and meanwhile they can go everywhere else while not in school without wearing a mask? Shake your head and think about this double standard.

This mother here says to you both - Leave my child alone and my child will not be wearing a mask!!

We've taken steps to protect our vulnerable so let the children live and be happy! STOP this fear mongering!!

BTW - my 99 year old "unvaccinated" grandmother caught COVID-19 and survived. Explain that one - in other words move!!

A Concerned Parent,

21(1)

Expert Report on Masks in the Context of Covid-19

Prepared at the Request of:

Dominic Desjarlais, Lawyer

1188 Union Ave.

Office 626

Montreal (Quebec)

H3B 0E5

Prepared By:

William Code MD, FRCPC

5816 Menzies Road

Duncan, BC, Canada V9L 6J9

Table of Contents

I. Introduction

I write this expert report as a Canadian Anesthesiologist qualified as a specialist in Canada and the USA since 1988. Anesthesiologists are the undisputed experts of breathing in co-captaincy with ENT surgeons and respirologists. Prior to specialty training in anesthesia and intensive care, I had four years of prior experience in family practice in Hudson Bay, Saskatchewan. In that practice, I did a great deal of obstetrics and pediatric care including a life-saving intubation of a 3-year-old child with epiglottitis (a severe and acute infection of the throat). I spent ten years in academia teaching and research, especially stroke. Hence, I am comfortable and familiar with the literature review needed for the purpose of the present report.

Over the last 40 years of medical practice, I have cared acutely for many children. On a personal basis, my wife, Denise, and I have raised 3 children and now have 3 grandchildren.

II. Evidence Based Medicine for Making Decisions in Science and Medicine

I have included below this useful diagram/pyramid outlining the significance of different published studies. This is key to COVID-19 mask discussion as this changed diametrically, 180 degrees, for no valid reason. I will detail this within the report but, in essence, the evidence against mask wearing for the general population is of very high quality, from the top of the pyramid, which includes Randomized Controlled Trials (RCT), Systematic Reviews and the Meta-Analyses thereof. Meanwhile, the evidence supporting mask wearing for the general population is of extremely low quality and comes well down the pyramid.[1]

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[1] Ioannidis, John P. "Why Most Published Research Findings Are False." PLoS Medicine 2, no. 8 (August 30, 2005). https://doi.org/10.1371/journal.pmed.0020124.
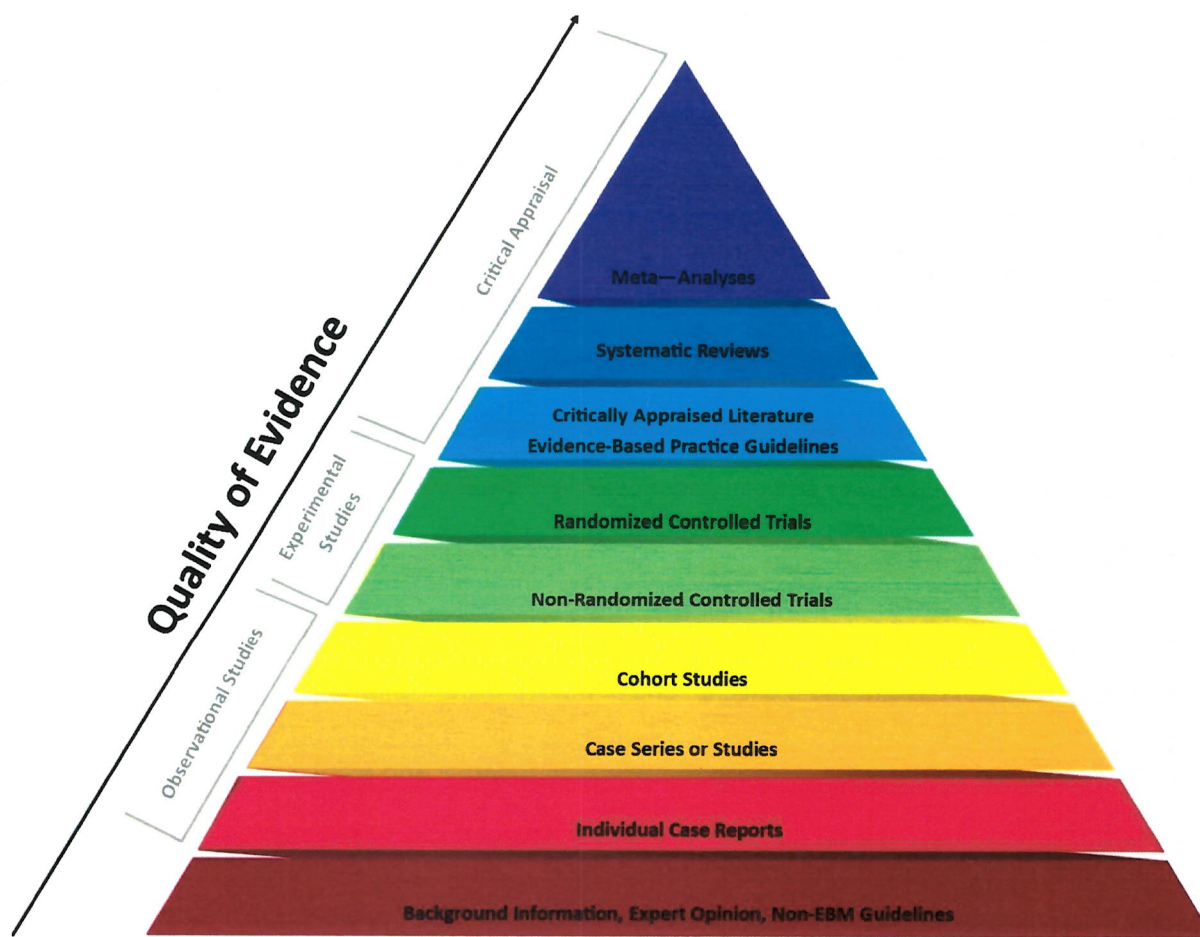
Figure 1: From Novella 2017[2]

It is interesting to note that the wearing of masks of any type was not recommended in the beginning few months of the COVID-19 crisis by any health organization or public health officials in Canada or Quebec.[3, 4, 5, 6] I have reviewed the various statements made by Dr. Horacio Arruda, Public Health Director of Quebec, during press conferences in March and April 2020 concerning the non-

[2] Novella, Steven. "Responding to SBM Critics." Science, April 19, 2017. https://sciencebasedmedicine.org/responding-to-sbm-critics/.

[3] Conférence de presse de M. François Legault, premier ministre, et Mme Danielle McCann, ministre de la Santé et des Services sociaux - National Assembly of Québec, March 2020. http://www.assnat.qc.ca/en/actualites-salle-presse/conferences-points-presse/ConferencePointPresse-58209.html.

[4] Conférence de presse de M. François Legault, premier ministre et Mme Danielle McCann, ministre de la Santé et des Services sociaux - National Assembly of Québec, April 2020. http://www.assnat.qc.ca/en/actualites-salle-presse/conferences-points-presse/ConferencePointPresse-58757.html.

[5] Conférence de presse de Mme Geneviève Guilbault, vice-première ministre, et Mme Danielle McCann, ministre de la Santé et des Services sociaux - National Assembly of Québec, April 2020. http://www.assnat.qc.ca/en/actualites-salle-presse/conferences-points-presse/ConferencePointPresse-58919.html.

[6] Conférence de presse de M. François Legault, premier ministre, et Mme Danielle McCann, ministre de la Santé et des Services sociaux - National Assembly of Québec, April 2020. http://www.assnat.qc.ca/en/actualites-salle-presse/conferences-points-presse/ConferencePointPresse-58993.html.

recommendation of the wearing of masks for the general population. For the statement that were made in French, I have used a translator software to translate them in English. The various statements made by Dr Arruda, of Quebec, can be summarized as follows:

i) The wearing of a mask does not protect the person who wears it;

ii) The wearing of a mask gives a false impression of security;

iii) The wearing of a mask creates a risk of auto-contamination/auto-infection;

iv) The wearing of a mask is not part of our culture, and the population is not used to wearing such an object;

v) It is preferable for a person to cough in her elbow and then go wash her hands rather than wearing a mask full of secretions, to touch the mask with her hands and to touch something after;

vi) The procedural mask must be used in a controlled situation in the context of medical/health care setting;

vii) A person must not have the impression that the mask will protect her;

viii) It is very difficult for a person to wear a mask all day, but if a person wants to be a champion and be in the book of records, then do it;

The statements made by Dr. Arruda in March and April of 2020 were common sense and were in accordance with the existing science regarding the wearing of mask to the effect that it should be reserved for the context of medical care between doctors/health personnel and patients, as well as for sick people, and not for the general population. Further credence to this concept is seen in Dr. Anthony Fauci's email of February 2020, reproduced just below.[7] This science has not changed since March and April 2020, to the contrary.

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[7] Carlson, Tucker. Tucker Carlson: Two-faced Fauci pushed draconian measures despite data, June 5, 2021. https://www.msn.com/en-us/news/opinion/tucker-carlson-two-faced-fauci-pushed-draconian-measures-despite-data/ar-AAKIDIR.

From: Fauci, Anthony (NIH/NIAID) [E]
Sent: Wed, 5 Feb 2020 03:48:11 +0000
To: Sylvia Burwell
Subject: RE: A couple of quick questions.

Sylvia:

Masks are really for infected people to prevent them from spreading infection to people who are not infected rather than protecting uninfected people from acquiring infection. The typical mask you buy in the drug store is not really effective in keeping out virus, which is small enough to pass through the material. It might, however, provide some slight benefit in keep out gross droplets if someone coughs or sneezes on you. I do not recommend that you wear a mask, particularly since you are going to a vey low risk location. Your instincts are correct, money is best spent on medical countermeasures such as diagnostics and vaccines.

Safe travels.
Best regards,
Tony

From: Sylvia Burwell   (b) (6) >
Sent: Tuesday, February 4, 2020 10:24 PM
To: Fauci, Anthony (NIH/NIAID) [E]   (b) (6)
Subject: A couple of quick questions.

Begin forwarded message:

Despite the statements made by Dr. Arruda in March and April 2020, the Quebec Government, in July 2020, decided to impose the wearing of masks for the general population in closed public places. This demonstrates the decision to impose masks to the general population was a political decision, and not a decision based on the relevant science, which was, and still is, to the effect that the wearing of masks for the general (asymptomatic) population does not protect against the transmission of a virus such as SARS-CoV-2.

This was because the published literature stated masks were not helpful and were even harmful. Any "studies" contrary to this are very low on the above pyramid, and so should be given little emphasis. For obscure and unexplained reasons, Dr. Anthony Fauci, U.S. Surgeon General, and Canadian public health officials reversed these recommendations in the summer of 2020. I suggest this was for political reasons, perhaps to reassure the population in Canada and the USA that everything that could to be done was being done, including masks. This dogma is reinforced by Worker's Compensation boards provincially and affected all places of business. I suggest this edict has caused much more harm than benefit and I will endeavor to explain this. An interesting sidebar is that recent evidence in support of

mask wearing is all in the very weak category. Meanwhile, the evidence against mask wearing is of major and of high quality, including many well done randomized controlled trials (RCT).

III. What is COVID-19 and What are the Risks?

COVID-19 is the name of a disease or syndrome which appeared in late 2019. The acronym, "COVID-19" signifies "CO" as coronavirus, "VI" as virus, and "D" as disease. The 19 is for the year first described as 2019.

Meanwhile, SARS-CoV-2 is the name of the coronavirus which triggers the illness COVID-19. In this acronym, SARS means "severe acute respiratory syndrome", CoV signifies Coronavirus, and 2 is in deference to the forerunner, SARS-CoV-1, described in 2002-2004. There have now been 7 coronaviruses experienced by humans, notably in the last 30-40 years. Three of these evolved from animal strains.

The term "corona" virus comes from the spike proteins on the virus which look like the points of a crown or corona. These are present throughout our body as they line the inner surface of all blood vessels' interior lining or endothelium. This helps explain COVID-19 complications: strokes in people 20-40 years of age, kidney disease, heart and liver failure. In addition, we now know those most susceptible to severe COVID-19 are those with co-morbidities. I have referenced both CDC and Quebec data on this.[8, 9] This revealed only 5% of all deaths from COVID-19 mention just COVID on the death certificate. All the rest had co-morbidities.

The SARS-CoV-2 virus makes many people experience excess clotting which is also called hypercoagulability. This explains also the "COVID-19 toe", described where a toe turns black due to a clot blocking the artery. No blood flow means no oxygen, and so the toe turns black. Excess clotting also explains the frequent blood clots in the leg or pelvic veins. When these clots break free, they travel to the lungs and are called pulmonary emboli. In the 1970s, these were nicknamed "Nixon's disease" as Richard Nixon, one of the former US presidents, suffered from this.

[8] "COVID-19 Provisional Counts - Weekly Updates by Select Demographic and Geographic Characteristics." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, May 26, 2021. https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm#Comorbidities.
[9] Simard, Marc. "Impact of Comorbidities on the Risk of Death and Hospitalization among Confirmed Cases of COVID-19 during the First Months of the Pandemic in Québec." INSPQ. Institut national de santé publique du Québec, December 14, 2020. https://www.inspq.qc.ca/en/publications/3082-impact-comorbidities-risk-death-covid19.

If the blood clots are too large, or there are too many, the oxygenation of the blood diminishes dramatically and can cause sudden death. If the patient initially survives, they will have very low oxygenation and their pulse oximetry, or O_2 saturation, will drop precipitously. The secondary low oxygen will trigger acute inflammation, due to hypoxia of any or all tissues. This is described as a "cytokine storm" due to the body's rapid release of these inflammatory molecules.

In the early days of March 2020, COVID-19 death rates were high as the cases that were counted reached hospitals quite late and were usually extremely sick. This was one of the major issues in Italy, the UK, and even New York City. This initiated the incredible fear in our societies. By May and June, much more was known about COVID-19. This should have reduced our public health officials' interventions, but it did not and still has not, namely in Quebec and most of Canada.

SARS-CoV-1 is the nearest coronavirus relative of SARS-CoV-2. They share 79.6% of the same genetics.[10] SARS-CoV-1 did pose a high fatality risk with the 8,098 cases confirmed globally, causing 774 deaths with a "case fatality rate" of 9.6%. Meanwhile, the "case fatality rate" of SARS-CoV-2 is closer to 0.3% or less but is quite age particular. For example, USA CDC data describes ages 0-19 years at 0.003%, 20-40 years as 0.02%, 50-69 years as 0.5%, and aged 70 plus as 5.4%.[11, 12]

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[10] Rahimi, Azadeh, Azin Mirzazadeh, and Soheil Tavakolpour. "Genetics and Genomics of SARS-CoV-2: A Review of the Literature with the Special Focus on Genetic Diversity and SARS-CoV-2 Genome Detection." Genomics 113, no. 1 (January 2021): 1221–32. https://doi.org/10.1016/j.ygeno.2020.09.059.
[11] "Canada." Worldometer. Accessed May 31, 2021. https://www.worldometers.info/coronavirus/country/canada/.
[12] "COVID Data Tracker Weekly Review." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, May 28, 2021. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html.

Canadian data supplied by WHO in 2021 revealed fatalities as follows:

Years	Fatalities
0 to 9	0%
10 to 39	0.2%
40 to 49	0.4%
50 to 59	1.3%
60 to 69	3.6%
70 to 79	8.0%
80 and over	14.8%

Table 1: WHO Data of Fatalities in Canada

Unlike SARS-CoV-1, which troubled almost everyone, SARS-CoV-2 causes deaths in the very old, and greater than 95% of all deaths have one or more co-morbidities.[11, 12] These include hypertension, diabetes mellitus, obesity, heart disease and cancer.

The mortality risk for those infected with SARS-CoV-2 is not the same for all patients. Older patients are at a higher risk of death if infected, while younger patients face a vanishingly small risk. The best advice on age-specific infection fatality rates comes from seroprevalence studies. Modern medicine has used these studies for decades with great accuracy and understanding. The definition of seroprevalence of COVID-19 is the fraction of people within a population who have specific antibodies against SARS-CoV-2 in their bloodstream. I can only guess why we do not have Canadian data as this test has been available at the major private lab in Canada, Lifelabs, in both Ontario and BC, so 19-20 million people have access. On December 27, 2020, this is where my wife and I both confirmed positive for antibodies to SARS-CoV-2. This is in contrast to the erratic and up to 95% false positive in the use of the PCR (Polymerase Chain Reaction) test being used aggressively to literally "control the numbers and narrative" by the public health officials in both Quebec and throughout Canada. By using higher 40-45 dilutions in the PCR test, they can hugely enhance the "false positive cases" and control the public narrative. However, almost no real cases of COVID-19 are clinically confirmed. Unfortunately, the media

has taken these numbers as gospel and the fear component has been increasingly ramped up as a consequence.

The USA's CDC's best estimates of the symptomatic fatality rate from COVID-19 among patients less than 50 years old is 0.05%, or 5 in 10,000; 0.2% for patients between ages 50 and 64; and 1.3% for patients 65 and above.

A study of the seroprevalence of COVID-19 in Geneva, Switzerland provides a detailed age break down of the infection survival rate: 99.9984% for patients 5 to 9 years old; 99.99968% for patients 10

to 19 years old; 99.9915% for patients 20-49 years old; 99.86% for patients 50-64 years old; and 94.6% for patients aged over 65 years. [13, 14]

Seroprevalence assessment in Quebec and Canada reveals 2.5 to 10% presence of COVID antibodies.[13, 14]

In summary, SARS-CoV-2 does not pose a real or imminent serious threat to the population in general, but only to the health of a specific part of the population – the elderly and a limited number of people with certain chronic conditions and/or comorbidities. Age is still the most important risk factor, with a worldwide 99.95% infection survival rate for people under 70 and 95% infection survival rate for people aged 70 years and more. In essence, the risk is little different to an annual influenza, for example, the one that affected Canada in 2017. It is important to note that COVID-19 illness when it appeared in Canada in early 2020, came after two years of quite low flu death rates. As per the USA CDC records related to flu 2017 at 61,000 deaths, 2018 had 24,000 deaths and 2019 had 22,000 deaths, though only through to March (typically runs through May for the flu season). Consequently, many of the frail elderly that would have ordinarily died from flu in 2018 and 2019 suddenly died secondary to SARS-CoV-2. However, the true SARS-CoV-2 death rate did not reach the true number of flu deaths of 2017.[15] It must

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[13] Stringhini, Silvia, Ania Wisniak, Giovanni Piumatti, Andrew S Azman, Stephen A Lauer, Hélène Baysson, David De Ridder, et al. "Seroprevalence of Anti-SARS-CoV-2 IgG Antibodies in Geneva, Switzerland (SEROCoV-POP): a Population-Based Study." The Lancet 396, no. 10247 (June 11, 2020): 313–19. https://doi.org/10.1016/s0140-6736(20)31304-0.
[14] Perez-Saez, Francisco, Stephen Lauer, Laurent Kaiser, Simon Regard, Elisabeth Delaporte, Idris Guessous, Silvia Stringhini, and Andrew Azman. "Serology-Informed Estimates of SARS-COV-2 Infection Fatality Risk in Geneva, Switzerland." OSF Preprints, June 12, 2020. https://doi.org/10.31219/osf.io/wdbpe.
[15] "2017-2018 Estimated Influenza Illnesses, Medical Visits, Hospitalizations, and Deaths and Estimated Influenza Illnesses, Medical Visits, Hospitalizations, and Deaths Averted by Vaccination in the United States."

be noted that the rules were changed by the CDC in early 2020 as deaths of people "with COVID" now included heart attacks, cancer and even gunshot wounds to the head if COVID-19 was noted in the previous 3 months. This skewed the COVID-19 deaths dramatically.

In light of the foregoing, it appears that COVID-19 does not constitute a serious threat to the health of the population, whether real or imminent, as it does not affect or pose a risk to the greater majority of the population, and only poses a risk for some people over 70 years of age.

IV. Transmission of SARS-CoV-2 from Children to Adults

The scientific data suggests the risk of transmission of the virus from younger people aged 18 and below to older people is small or negligible. Certainly, the key evidence of this is from a study in Iceland and published in the New England Journal of Medicine (NEJM).[16] This study looked at SARS-CoV-2 virus samples in all positive cases, sequenced their genome for every case and tracked the mutation pattern of the virus. This analysis, along with contact tracing data, allowed the team to identify definitively who passed the virus to whom. The hundreds of minor mutations identified provide a unique fingerprint of sorts, which make it possible to tell whether two patients could possibly have passed the virus to one another. From this analysis, the senior author of the study, Dr. Kari Stefansson, concluded that "even if children do get infected, they are less likely to transmit the disease to others than adults. We have not found a single instance of a child infecting their parents."[17]

"A French study at the L'Institut Pasteur, examined data from late April 2020 on schoolteachers, students, and their parents in Crepy-en-Valois in France."[18] This study, again using seroprevalence or antibody tests, found no evidence of virus spread to other children or teachers from known earlier cases.

Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, November 22, 2019. https://www.cdc.gov/flu/about/burden-averted/2017-2018.htm?web=1&wdLOR=c77DF78CA-7904-E54A-B008-E643C147B31E.

[16] Gudbjartsson, Daniel F., Gudmundur L. Norddahl, Pall Melsted, Kristbjorg Gunnarsdottir, Hilma Holm, Elias Eythorsson, Asgeir O. Arnthorsson, et al. "Humoral Immune Response to SARS-CoV-2 in Iceland." New England Journal of Medicine 383, no. 18 (2020): 1724–34. https://doi.org/10.1056/nejmoa2026116.

[17] Scheid, Jennifer L., Shannon P. Lupien, Gregory S. Ford, and Sarah L. West. "Commentary: Physiological and Psychological Impact of Face Mask Usage during the COVID-19 Pandemic." International Journal of Environmental Research and Public Health 17, no. 18 (September 12, 2020): 6655. https://doi.org/10.3390/ijerph17186655.

[18] Fontanet, Arnaud, Rebecca Grant, Laura Tondeur, Yoann Madec, Ludivine Grzelak, Isabelle Cailleau, Marie-Noëlle Ungeheuer, et al. "SARS-CoV-2 Infection in Primary Schools in Northern France: A Retrospective Cohort Study in an Area of High Transmission." medRxiv. Cold Spring Harbor Laboratory Press, June 29, 2020. https://doi.org/10.1101/2020.06.25.20140178.

The main contacts of the younger children were their parents, of whom 61% were positive, which is consistent with parent to child spread. The authors' main conclusion from these facts is that the parents were the source of infections in school children: children were not the source.[19]

Irish researchers conducted a similar study which analyzed 1,160 children and adults.[20] They reported finding no instance of an infected child infecting another child. This was despite the fact the infected children participated in "music lessons (woodwind instruments)" and choir practice, both of these being high-risk activities for transmission.

A German study reports a strikingly similar finding on the likelihood of pediatric disease spread.[21] The authors found the source of infection turned out to be a parent 85% of the time. They concluded that "In contrast to other epidemic viral respiratory infections, the primary source of infection with SARS-CoV-2 appears not to be other children".

One of the largest studies in the world on coronavirus in schools carried out in 100 institutions in the UK, recently confirmed that "there is little evidence that the virus is transmitted in schools" based on this extensive study.[22]

A study of 23 family disease clusters in Greece, published in August 2020, found that in 91% of the clusters, an adult was the first person to be infected.[23] They found no evidence of either child-to-adult spread, or even child-to-child.

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[19] Roeckner, Jared T., Nevena Krstić, Bradley H. Sipe, and Sarah G. Običan. "N95 Filtering Facepiece Respirator Use during Pregnancy: A Systematic Review." American Journal of Perinatology 37, no. 10 (May 21, 2020): 995–1001. https://doi.org/10.1055/s-0040-1712475.

[20] Highfield, Roger. "Coronavirus: Hunting down COVID-19." Science Museum Group, April 27, 2020. https://www.sciencemuseumgroup.org.uk/blog/hunting-down-covid-19/.

[21] "COVID-19 in Primary Schools: No Significant Transmission among Children or from Students to Teachers." Institut Pasteur, June 23, 2021. https://www.pasteur.fr/en/press-area/press-documents/covid-19-primary-schools-no-significant-transmission-among-children-students-teachers.

[22] Sian Griffiths, Education Editor. "'Pupils Pose Little Risk of Spreading Covid'." News | The Sunday Times. The Sunday Times, August 9, 2020. https://www.thetimes.co.uk/article/pupils-pose-no-risk-of-spreading-covid-27q6zfd9l.

[23] Maltezou, Helena C., Rengina Vorou, Kalliopi Papadima, Athanasios Kossyvakis, Nikolaos Spanakis, Georgia Gioula, Maria Exindari, et al. "Transmission Dynamics of SARS-CoV-2 within Families with Children in Greece: A Study of 23 Clusters." Journal of Medical Virology 93, no. 3 (August 26, 2020): 1414–20. https://doi.org/10.1002/jmv.26394.

In the above studies, the Icelandic one is the most complete and detailed and is now the gold standard. No quality studies have disproved this study, or the other above-mentioned studies to date. In short, SARS-CoV-2 transmission of children-to-adults is very rare, and child-to-child is also quite rare.

Another approach to this topic is analyzing the effect of actual school closures on the spread of the epidemic within countries. One would expect that countries that closed schools would see a significant effect of this policy on disease spread. In fact, the opposite is the case, as suggested by studies in Japan, New South Wales, Australia, and Sweden/Finland.[24, 25, 26] In addition, a systematic review of this evidence concluded "opening up schools and kindergartens is unlikely to impact COVID-19 mortality rates in older people,"[27]

Newer information confirms wearing a mask of any kind increases the transmission of SARS-CoV-2 virus between individuals rather than reducing it.[19, 20]

Admittedly, there are some counter examples in firstly Israel, and secondly, Georgia, USA.[28, 29] "In Israel, infections among children increased steadily after schools opened. That paralleled a rise in cases nationwide". Hence, it is difficult to determine cause and effect.

The Georgia summer camp anecdote is not a good analogy for schools.[29] There, the kids were older, they slept together in crowded cabins and engaged in lots of singing and screaming. Furthermore, a

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[24] Iwata, Kentaro, Asako Doi, and Chisato Miyakoshi. "Was School Closure Effective in Mitigating Coronavirus Disease 2019 (COVID-19)? Time Series Analysis Using Bayesian Inference." International Journal of Infectious Diseases 99 (July 31, 2020): 57–61. https://doi.org/10.1016/j.ijid.2020.07.052.

[25] Macartney, Kristine, Helen E Quinn, Alexis J Pillsbury, Archana Koirala, Lucy Deng, Noni Winkler, Anthea L Katelaris, et al. "Transmission of SARS-CoV-2 in Australian Educational Settings: a Prospective Cohort Study." The Lancet Child & Adolescent Health 4, no. 11 (November 1, 2020): 807–16. https://doi.org/10.1016/s2352-4642(20)30251-0.

[26] "Covid-19 in Schoolchildren – A Comparison between Finland and Sweden." The Swedish Public Health Agency, July 7, 2020. https://www.folkhalsomyndigheten.se/publicerat-material/publikationsarkiv/c/covid-19-in-schoolchildren/.

[27] Ludvigsson, Jonas F. "Children Are Unlikely to Be the Main Drivers of the COVID-19 Pandemic – A Systematic Review." Acta Paediatrica 109, no. 8 (May 19, 2020): 1525–30. https://doi.org/10.1111/apa.15371.

[28] Kershner, Isabel, and Pam Belluck. "When Covid Subsided, Israel Reopened Its Schools. It Didn't Go Well." The New York Times. The New York Times, August 4, 2020. https://www.nytimes.com/2020/08/04/world/middleeast/coronavirus-israel-schools-reopen.html.

[29] McCabe, Caitlin. "Latest Research Points to Children Carrying, Transmitting Coronavirus." The Wall Street Journal. Dow Jones & Company, August 10, 2020. https://www.wsj.com/articles/latest-research-points-to-children-carrying-transmitting-coronavirus-11596978001.

counter to the Georgia story is a study "of 1,900 children attending an urban summer schools camp in Barcelona, Spain."[30] They "found only 39 new index cases (30 pediatric)."

This is from a recent and comprehensive report by Public Health England. English schools were reopened on June 1, 2020, despite high community case numbers, as they recognized children hardly spread SARS-CoV-2.[31] The author stated that cases and outbreaks were "uncommon across all educational settings". In response to this study the UK education minister Gavin Williamson said, "one of the largest studies on the coronavirus in schools in the world… makes it clear there is little evidence that the virus is transmitted at school."[32] Also, as of May 17,2021, all UK school children and colleges will no longer require masks in school classrooms or communal areas.[33]

V. Pro Mask Evidence is Weak

Before proceeding further, I will outline the "pro-mask" evidence so my outline of mask avoidance can be seen in its fullest of light. Almost all of the "pro-mask" evidence was done hurriedly and with a desired endpoint to confirm mask's value in reducing SARS-CoV-2 transmission. This is a dangerous starting point for quality research. Most of it has been general observation, mathematic modelling and anecdotal.[34] The best example is from a Lancet article of June 2020.[35] This is "quoted" as evidence and though it sounds important as it is from a major journal, it is still at the very lowest part of the "research pyramid" shown earlier. Further evidence of this "pro-mask" change in policy comes from the June 5th, 2020, WHO, interim guidance document.[36]

[30] Güell, Oriol. "Major Coronavirus Study in Spanish Summer Camps Shows Low Transmission among Children." EL PAÍS, August 26, 2020. https://english.elpais.com/society/2020-08-26/major-coronavirus-study-in-spanish-summer-camps-shows-low-transmission-among-children.html.
[31] England, Public Health. "COVID-19: Guidance for Health Professionals." GOV.UK. GOV.UK, March 15, 2021. https://www.gov.uk/government/collections/wuhan-novel-coronavirus.
[32] "Coronavirus: Little Evidence of Covid Transmission in Schools, Says Williamson." BBC News. BBC, August 10, 2020. https://www.bbc.com/news/uk-53718066.
[33] Education, Department for. "Face Coverings No Longer Required in Schools and Colleges from 17 May." GOV.UK. GOV.UK, May 10, 2021. https://www.gov.uk/government/news/face-coverings-no-longer-required-in-schools-and-colleges-from-17-may.
[34] Ioannidis, John P.A., Sally Cripps, and Martin A. Tanner. "Forecasting for COVID-19 Has Failed." International Journal of Forecasting, August 25, 2020. https://doi.org/10.1016/j.ijforecast.2020.08.004.
[35] Chu, Derek K, Elie A Akl, Stephanie Duda, Karla Solo, Sally Yaacoub, Holger J Schünemann, Derek K Chu, et al. "Physical Distancing, Face Masks, and Eye Protection to Prevent Person-to-Person Transmission of SARS-CoV-2 and COVID-19: a Systematic Review and Meta-Analysis." The Lancet 395, no. 10242 (2020): 1973–87. https://doi.org/10.1016/s0140-6736(20)31142-9.
[36] World Health Organization. "Advice on the use of masks in the context of COVID-19: Interim guidance, 5 June 2020." World Health Organization. World Health Organization, 2020. https://apps.who.int/iris/handle/10665/332293. License: CC BY-NC-SA 3.0 IGO

This best effort of evidence for the use of wearing masks was commissioned by the WHO and published in the Lancet in June 2020.[34] The title, "Physical Distancing, Face Masks, and Eye Protection to Prevent Person-to-Person Transmission of SARS-CoV-2 and COVID-19: A Systematic Review and Meta-Analysis", sounds like high level scientific evidence. After all, systemic reviews and meta-analyses are typically considered the epitome of evidence-based medicine. However, please do not be deceived by the authors' deceptive attempts to elevate the relevancy of this study. This systemic review/meta-analysis was entirely comprised of low-level observational studies. No high-level randomized controlled trials were included because there are none! For a more comprehensive analysis of the flaws and a relative debunking of the relevance of this study, please refer to: WHO Mask Study Seriously Flawed, Swiss Policy Research (Sept.9, 2020)[37]

VI. Evidence in Support of "No Masks"

I will now review the research on viral transmission done in the cool of the day, before the frenzy and fear of COVID-19. I have been assisted, to a major degree, by two very recent reviews on the topic by Vainshelboim[38] and Kisielinski.[39]

An excellent article published in November 2020 by Vainshelboim hypothesized the following:

1. The practice of wearing masks has compromised safety and efficacy profile.

2. Both medical and non-medical face masks are ineffective in reducing human-to-human transmission and infectivity of SARS-CoV-2 and CoVID-19.

3. Wearing face masks has adverse physiological and psychological effects.

4. Long term consequences of wearing face masks on health are detrimental.

Evolution of the above hypotheses:

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[37] "Are Face Masks Effective? The Evidence." Swiss Policy Research, May 2021. https://swprs.org/face-masks-evidence/.
[38] Vainshelboim, Baruch. "Facemasks in the COVID-19 Era: A Health Hypothesis." Medical Hypotheses 146 (November 22, 2020): 110411. https://doi.org/10.1016/j.mehy.2020.110411.
[39] Kisielinski, Kai, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch. "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" International Journal of Environmental Research and Public Health 18, no. 8 (April 20, 2021). https://doi.org/10.3390/ijerph18084344.

1. Breathing physiology

Breathing is critical to sustain life and health. Breathing removes metabolic byproducts (CO_2, carbon dioxide) and supplies fresh oxygen (O_2) which is critical to every cell for energy production (mitochondria). Chronic, mild, or moderately low O_2 and elevated CO_2 levels, such as from wearing face masks leads to reduced metabolism, acid increase in the blood (extra CO_2 dissolved becomes carbonic acid very rapidly) and increased oxidative stress. Hypoxia increases free radical production and inflammation and causes immunosuppression and health deterioration.[40, 41, 42, 43] These deleterious effects are especially of concern in small children less that 10 years of age as I will now outline. To survive, children have a much faster metabolic rate, so they need to breathe more quickly to permit more O_2 in and more CO_2 out. Basal metabolic rate (BMR) is especially rapid from newborn to 2 years of age. The BMR slowly decreases to the adult equivalent in early adolescence.[44]

2. Efficacy of face masks

The structure of both medical and non-medical (cloth) masks suggest that facemasks are ineffective to block viral particles due to their permeability to virus sized particles. The SARS-CoV-2 virus size is a diameter of 60-140 nm (nanometers or 1 billionth of a meter).[45] Meanwhile, facemask thread diameter and the relative "gap" between threads is 55-400 microns (one millionth of a meter). Hence, the virus is 1000 times smaller. Even if one states some virus particles coalesce with a water droplet, most will still penetrate the mask. In fact, the efficiency

[40] American College of Sports Medicine. ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription. 6th ed. Baltimore, MD: Lippincott Williams & Wilkins, 2010.

[41] Farrell, Peter A., Michael J. Joyner, and Vincent J. Caiozzo. ACSM's Advanced Exercise Physiology. 2nd ed. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2012.

[42] Kenney, W. Larry, David L. Costill, and Jack H. Wilmore. Physiology of Sport and Exercise. 5th ed. Champaign, Il: Human Kinetics, 2012.

[43] Chandrasekaran, Baskaran, and Shifra Fernandes. "'Exercise with Facemask; Are We Handling a Devil's Sword?' – A Physiological Hypothesis." Medical Hypotheses 144 (November 2020): 110002. https://doi.org/10.1016/j.mehy.2020.110002.

[44] Harris, J. A., and F. G. Benedict. "A Biometric Study of Human Basal Metabolism." Proceedings of the National Academy of Sciences 4, no. 12 (December 1, 1918): 370–73. https://doi.org/10.1073/pnas.4.12.370.

[45] Wiersinga, W. Joost, Andrew Rhodes, Allen C. Cheng, Sharon J. Peacock, and Hallie C. Prescott. "Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19)." JAMA 324, no. 8 (July 10, 2020): 782. https://doi.org/10.1001/jama.2020.12839.

of facemasks ranges from 0.7% to 26% in cloth masks.[46] The filtration rate of surgical and N-95 masks drops to 15% and 58% respectively, if even a small gap occurs between the mask and the face.[47] This small gap is inevitable in almost all of us. It is aggravated as the mask becomes damp or wet as we all breathe out water vapour. Air breathed out then increases through gaps as wet masks produce increased resistance. Air always follows the path of least resistance.

Clinical studies have reinforced this consideration. In a randomized controlled trial to determine if face masks or no face mask made a difference, of 246 participants, 123 (or 50%) were symptomatic.[48] Assessments revealed that masks did not make a difference to infectivity. Symptomatic participants had fever, cough, sore throat, runny nose, etc. There was no difference for coronavirus droplet transmission of greater than 5 microns (well above a single virus). This essentially removes the water droplet "stated" benefit attributed to face masks. Yes, you should still cough or sneeze into your elbow or layers of a handkerchief, but masks are no help in reducing the risk of infection. In addition, this study determined that among asymptomatic individuals, there was no droplets or aerosol coronavirus detected from anyone with or without a mask: one cannot contract COVID-19 from someone without symptoms.

A meta-analysis of healthcare workers found no difference comparing no masks, surgical masks and N-95 masks.[48] Each was not effective against viral infections or influenza-like illness based on six Randomized Control Trials. A recent review of 33,867 participants in a community setting similarly found no difference in any of the three (no mask, surgical mask or N-95 mask).[49]

[46]Advice on the Use of Masks in the Community, during Home Care and in Health Care Settings in the Context of the Novel Coronavirus (2019-NCoV) Outbreak. Geneva, Switzerland: World Health Organization, 2020..
[47] Konda, Abhiteja, Abhinav Prakash, Gregory A. Moss, Michael Schmoldt, Gregory D. Grant, and Supratik Guha. "Aerosol Filtration Efficiency of Common Fabrics Used in Respiratory Cloth Masks." ACS Nano 14, no. 5 (April 24, 2020): 6339–47. https://doi.org/10.1021/acsnano.0c03252.
[48] Smith, Jeffrey D., Colin C. MacDougall, Jennie Johnstone, Ray A. Copes, Brian Schwartz, and Gary E. Garber. "Effectiveness of N95 Respirators versus Surgical Masks in Protecting Health Care Workers from Acute Respiratory Infection: a Systematic Review and Meta-Analysis." Canadian Medical Association Journal 188, no. 8 (May 7, 2016): 567–74. https://doi.org/10.1503/cmaj.150835.
[49] Chou, Roger, Tracy Dana, Rebecca Jungbauer, Chandler Weeks, and Marian S. McDonagh. "Masks for Prevention of Respiratory Virus Infections, Including SARS-CoV-2, in Health Care and Community Settings." Annals of Internal Medicine 173, no. 7 (October 6, 2020): 542–55. https://doi.org/10.7326/m20-3213.

In an earlier publication, the WHO stated that "face masks are not required as no evidence is available on its usefulness to protect non-sick persons".[50] In the same publication, the WHO declared that "cloth" masks "are not recommended under any circumstance."

The CDC in the US made similar recommendations, stating that only symptomatic people should consider wearing face masks.[51] Meanwhile, face masks were not recommended for asymptomatic people. In addition, there are especially vulnerable populations, such as those with mental health disorders, developmental disabilities, hearing impaired, (these folks lip read which is impossible with masks), children and patients with respiratory conditions, who are at significant health risks for complications and harm from face masks. Some key respiratory conditions which can be exacerbated by face masks include asthma, and allergies causing nasal stuffiness. Furthermore, children who snore secondary to large adenoids, tonsils or airway obstructions could be at risk of harmful effects from face masks.

The following diagrams track the use of masks in affecting COVID-19 cases. In short, they are not effective in reducing transmission or preventing COVID-19. Masks were mandated when COVID-19 cases were already at either their lowest or decreasing or just before case numbers started to increase again. The graphs below demonstrate mask mandates were ineffective in several European countries, US states, and Quebec.

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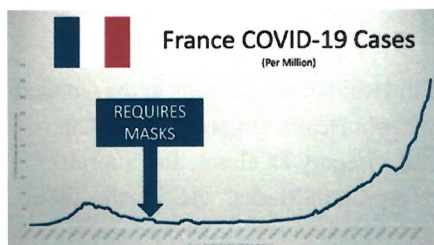
[50] Advice on the Use of Masks in the Context of COVID-19. Geneva, Switzerland: World Health Organization, 2020.
[51] Implementation of Mitigation Strategies for Communities with Local COVID-19 Transmission. . Atlanta, Georgia: Center for Disease Control and Prevention, 2020.
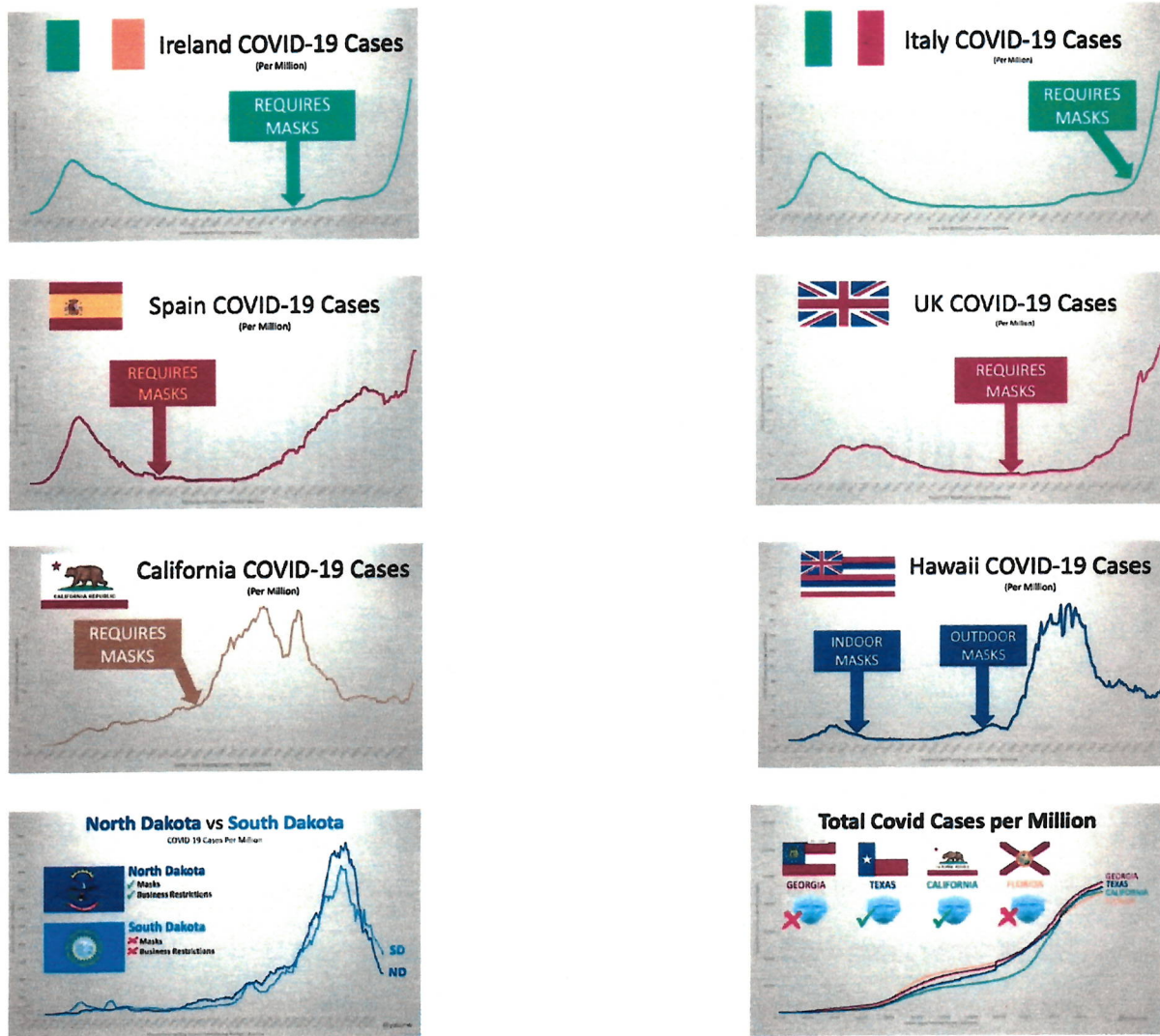
Figure 2: "Mask mandates and coronavirus infections"[37]

In Quebec:

1.2 - Évolution du nombre de cas confirmés de COVID-19 au Québec selon le type de confirmation et la date de déclaration des cas
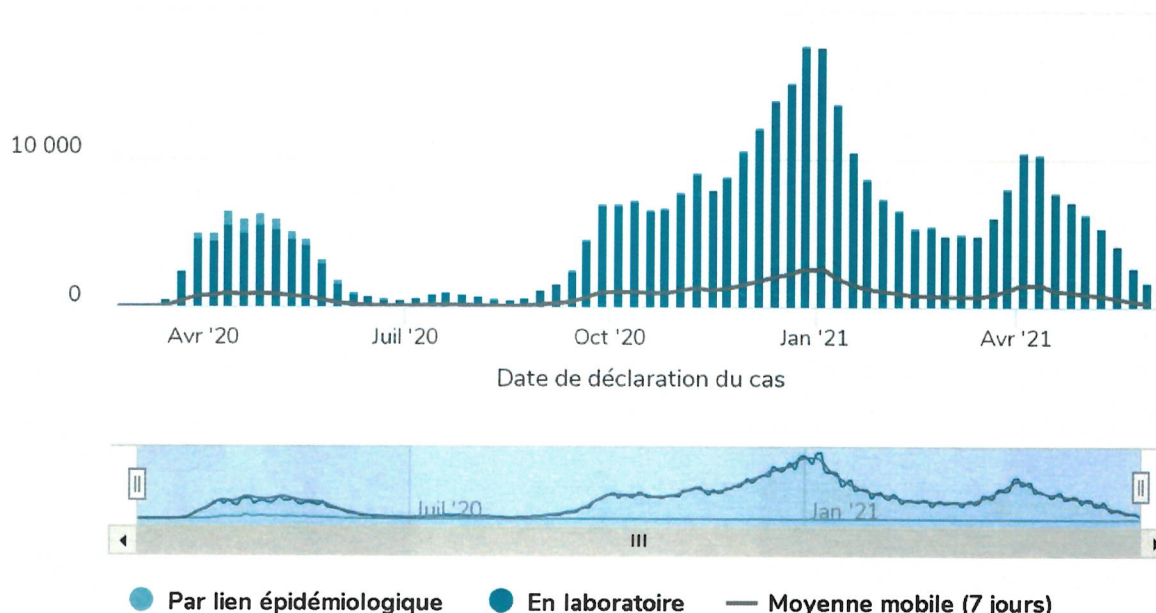

Figure 3: Evolution of the number of confirmed cases of COVID-19 in Quebec according to the type of confirmation and the date of declaration of cases.[52]

In Quebec masks were mandated in closed public places on July 18th, 2020, at a time when the number of cases was at its lowest level. The increase in the number of cases from September 2020 shows that masks had no impact on the transmission of SARS-CoV-2.

VII. Harmful Effects and Consequences of Face Masks

1. Physiological Effects of Face masks

Wearing a face mask reduces optimal breathing by increasing the resistance of air movement while breathing in or breathing out.[53, 54] The trapped air remaining between the mouth, nose and face mask is repeatedly rebreathed, and of course, contains lower concentration of oxygen and higher carbon dioxide concentration. This trapped air is termed "dead space" in medical

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[52] "Données COVID-19 Au Québec." INSPQ. Accessed June 2, 2021. https://www.inspq.qc.ca/covid-19/donnees/.

[53] Farrell, Peter A., Michael J. Joyner, and Vincent J. Caiozzo. ACSM's Advanced Exercise Physiology. 2nd ed. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2012.

[54] Kenney, W. Larry, David L. Costill, and Jack H. Wilmore. Physiology of Sport and Exercise. 5th ed. Champaign, Il: Human Kinetics, 2012.

terms. It is often doubled with a surgical face mask. This creates lower blood O_2 (hypoxemia) and higher CO_2 in the blood (hypercapnia).[39, 55, 56] In addition, the increased resistance to breathing causes everyone, particularly children, to increase their mouth breathing. This bypasses our nose which is our primary air filter and infection protection measure with both mucous and cilia (tiny hair cells) which deal with bacteria, viruses and fungi. The mask has all the problems of these organisms now, but no ability to deal with them biologically. The result is the rapid escalation of bacteria in the mask and also within the mouth ("mask mouth" per dentists) and lungs, even increasing pneumonia risk.[57, 58, 59] After only 2 hours of wearing a mask, the bacteria and fungi density increase tenfold.[60, 61] In a 230 surgical mask study, the bacterium Staphylococcus aureus (57% of all bacteria detected) and the fungus Aspergillus (31% of all fungi detected) were the dominant germs.[62] Once a secondary bacterial pneumonia occurs in COVID-19 patients, they are at a much higher risk of needing intensive care, and even of dying.

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[55] Kao, T W, K C Huang, T J Tsai, B S Hsieh, and M S Wu. "The Physiological Impact of Wearing an N95 Mask during Hemodialysis as a Precaution against SARS in Patients with End-Stage Renal Disease." J Formos Med Asso 103 (2004): 624–28.

[56] "UNITED STATES DEPARTMENT OF LABOR." 1910.134 - Respiratory Protection. | Occupational Safety and Health Administration, 2007. https://www.osha.gov/laws- regs/regulations/standardnumber/1910/1910.134.

[57]MacIntyre, C. R., H. Seale, T. C. Dung, N. T. Hien, P. T. Nga, A. A. Chughtai, B. Rahman, D. E. Dwyer, and Q. Wang. "A Cluster Randomised Trial of Cloth Masks Compared with Medical Masks in Healthcare Workers." BMJ Open 5, no. 4 (April 22, 2015). https://doi.org/10.1136/bmjopen-2014-006577.

[58] MacIntyre, C. R., and A. A. Chughtai. "Facemasks for the Prevention of Infection in Healthcare and Community Settings." BMJ 350 (April 9, 2015). https://doi.org/10.1136/bmj.h694.

[59] MacIntyre, C. Raina, Quanyi Wang, Holly Seale, Peng Yang, Weixian Shi, Zhanhai Gao, Bayzid Rahman, et al. "A Randomized Clinical Trial of Three Options for N95 Respirators and Medical Masks in Health Workers." American Journal of Respiratory and Critical Care Medicine 187, no. 9 (January 24, 2013): 960–66. https://doi.org/10.1164/rccm.201207-1164oc.

[60] Chughtai, Abrar Ahmad, Sacha Stelzer-Braid, William Rawlinson, Giulietta Pontivivo, Quanyi Wang, Yang Pan, Daitao Zhang, Yi Zhang, Lili Li, and C. Raina MacIntyre. "Contamination by Respiratory Viruses on Outer Surface of Medical Masks Used by Hospital Healthcare Workers." BMC Infectious Diseases 19, no. 1 (June 3, 2019). https://doi.org/10.1186/s12879-019-4109-x.

[61] Zhiqing, Liu, Chang Yongyun, Chu Wenxiang, Yan Mengning, Mao Yuanqing, Zhu Zhenan, Wu Haishan, et al. "Surgical Masks as Source of Bacterial Contamination during Operative Procedures." Journal of Orthopaedic Translation 14 (July 2018): 57–62. https://doi.org/10.1016/j.jot.2018.06.002.

[62] Luksamijarulkul, Pipat, Natkitta Aiempradit, and Pisit Vatanasomboon. "Microbial Contamination on Used Surgical Masks among Hospital Personnel and Microbial Air Quality in Their Working Wards: A Hospital in Bangkok." Oman Medical Journal 29, no. 5 (September 2014): 346–50. https://doi.org/10.5001/omj.2014.92.

2. Masks Increase Infection Risk

It is of particular note that the moisture which accumulates on any mask causes the distribution of these germs in the form of tiny droplets via capillary action on and in the mask. This creates further contamination internally and externally with every breath.[63] It is now also known, from a study, that masks create a proportionally disproportionate production of fine particles in the environment and surprisingly, much more so than in people without masks.[64] This same study further revealed that all mask-wearing subjects released significantly more smaller particles of size 0.3 to 0.5 microns into the air than mask-less people, both when breathing, speaking and coughing. This occurred in cloth, surgical and N95 masks. This means that wearing masks, including surgical masks, can increase your transmission of the vulnerable particle size which readily carries viruses and is not stopped by masks. It is known that aerosol droplets of 0.09 to 3 microns in size serve as a transport medium for viruses.[65] These penetrate the well fitted surgical mask by 40%. This penetration is higher if the mask is ill fitting, or touched, which is quite inevitable in many of us, particularly children. In fact, a recently published large prospective Danish comparative study comparing mask wearers and non-mask wearers in terms of their infection rates with SARS-CoV-2 could not demonstrate any statistical difference between the groups.[66] I agree with this no difference between groups from a clinical standpoint as well, which shows that masks are, in fact, inefficient in preventing transmission of SARS-CoV-2 virus.

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[63] Li, Y., H. Tokura, Y.P. Guo, A.S.W. Wong, T. Wong, J. Chung, and E. Newton. "Effects of Wearing N95 and Surgical Facemasks on Heart Rate, Thermal Stress and Subjective Sensations." International Archives of Occupational and Environmental Health 78, no. 6 (May 26, 2005): 501–9. https://doi.org/10.1007/s00420-004-0584-4.

[64] Asadi, Sima, Christopher D. Cappa, Santiago Barreda, Anthony S. Wexler, Nicole M. Bouvier, and William D. Ristenpart. "Efficacy of Masks and Face Coverings in Controlling Outward Aerosol Particle Emission from Expiratory Activities." Scientific Reports 10 (September 24, 2020): 15665 . https://doi.org/10.1038/s41598-020-72798-7.

[65] NCIRD. "COVID-19: Considerations for Wearing Masks." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, April 19, 2021. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html.

[66] Bundgaard, Henning, Johan Skov Bundgaard, Daniel Emil Raaschou-Pedersen, Christian von Buchwald, Tobias Todsen, Jakob Boesgaard Norsk, Mia M. Pries-Heje, et al. "Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers." Annals of Internal Medicine 174, no. 3 (March 2021): 335–43. https://doi.org/10.7326/m20-6817.

3. Physiologic Changes Secondary to Wearing a Mask

Central Nervesystem:

-Empathy ↓
-psycho-vegetative Reactions
-false Sense of Security
-Communication Disorder

-Headache
-Vasodilation
-Dizziness
-Drowsiness

Skin:

-Itching
-Irritation
-Acne
-impaired Skin Barrier

ENT:

-Rhinitis
-Voice Disorder

chemical:

•CO_2↑ •O_2↓

MASK EFFECTS

physical:
•Breathing Resistance ↑
•Deadspace ↑
•Temperature ↑
•Humidity ↑

biological:
•bacterial
•viral
•fungal
Contamination

Heart/ Lung / Circulation:

-Respiratory Impairment
-Exhaustion
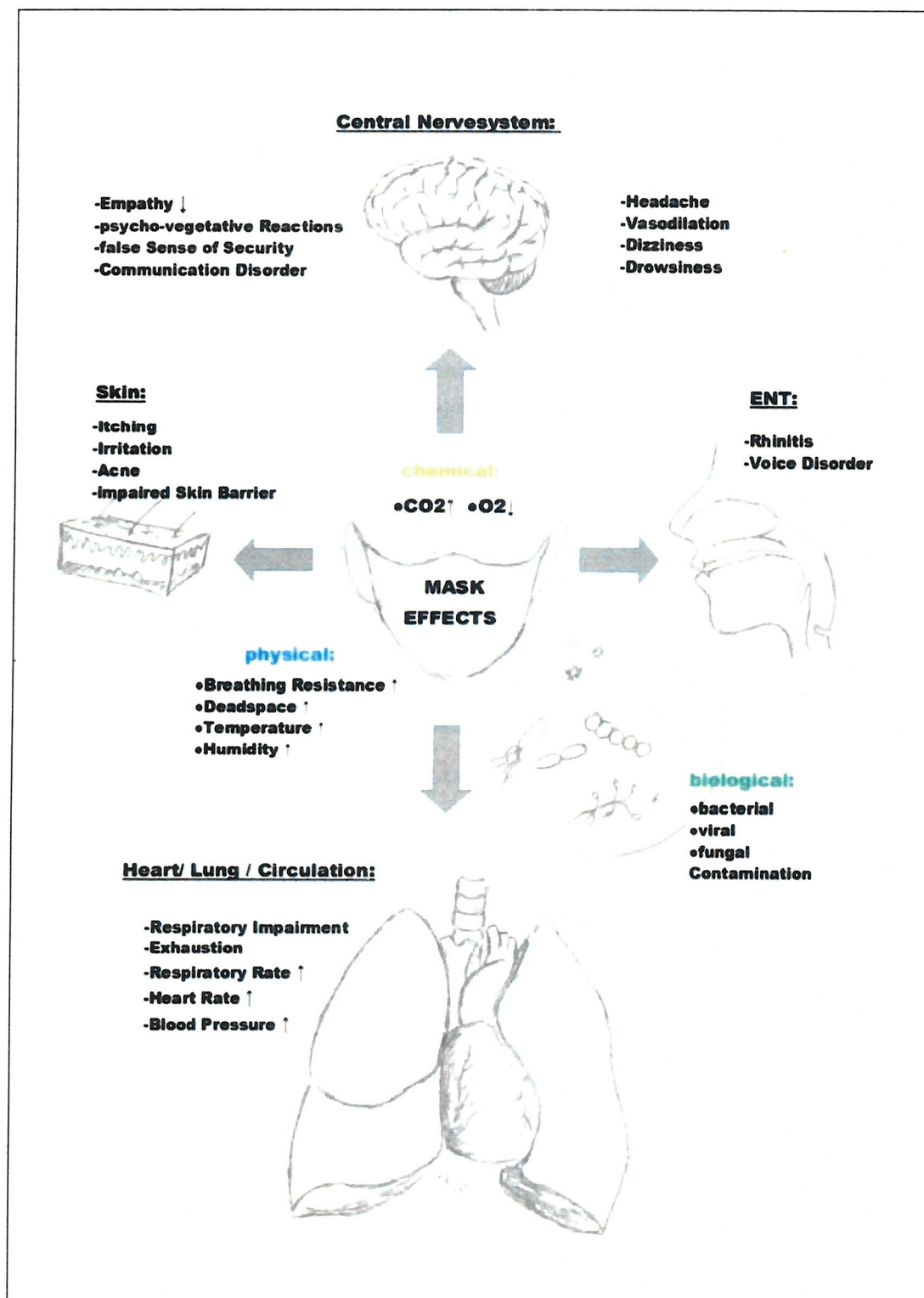-Respiratory Rate ↑
-Heart Rate ↑
-Blood Pressure ↑

Figure 4: "Unfavorable mask effects as component of Mask-Induced Exhaustion Syndrome (MIES). The chemical, physical and biological effects, as well as the organ system

consequences mentioned, are all documented with statistically significant results in the scientific literature found (Figure 2). The term drowsiness is used here to summarize any qualitative neurological deficits described in the examined scientific literature."[39]

Increased risk of adverse effects when using masks:

Internal diseases	Psychiatric illness	Neurological Diseases
COPD	Claustrophobia	Migraines and Headache Sufferers
Sleep Apnea Syndrome	Panic Disorder	Patients with intracranial Masses
advanced renal Failure	Personality Disorders	Epilepsy
Obesity	Dementia	
Cardiopulmonary Dysfunction	Schizophrenia	
Asthma	helpless Patients	
	fixed and sedated Patients	

Pediatric Diseases	ENT Diseases	Occupational Health Restrictions
Asthma	Vocal Cord Disorders	moderate / heavy physical Work
Respiratory diseases	Rhinitis and obstructive Diseases	
Cardiopulmonary Diseases		Gynecological restrictions
Neuromuscular Diseases	Dermatological Diseases	Pregnant Women
Epilepsy	Acne	
	Atopic	

Figure 5: "Diseases/predispositions with significant risks, according to the literature found, when using masks. Indications for weighing up medical mask exemption certificates."[39]

Within minutes of wearing any of the three mask types, mask wearers exhibit a major frequency of typical, measurable, physiological changes secondary to the masks. These changes are partly due to increased rebreathing of CO-2 due to increased dead space (about double with a mask) and due to increased breathing resistance.[67, 68] In addition, the gas content of oxygen is reduced about 14% from 20.9% in room air at sea level to 18.3%.[69] Consequently, there is a significant drop in blood O2 saturation, an increased heart rate and an increased respiratory or

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[67] Roberge, Raymond J., Jung-Hyun Kim, and Stacey M. Benson. "Absence of Consequential Changes in Physiological, Thermal and Subjective Responses from Wearing a Surgical Mask." Respiratory Physiology & Neurobiology 181, no. 1 (April 15, 2012): 29–35. https://doi.org/10.1016/j.resp.2012.01.010.

[68] ROBERGE, Raymond J., Aitor COCA, W. Jon WILLIAMS, Andrew J. PALMIERO, and Jeffrey B. POWELL. "Surgical Mask Placement over N95 Filtering Facepiece Respirators: Physiological Effects on Healthcare Workers." Respirology 15, no. 3 (May 2010): 569–77. https://doi.org/10.1111/j.1440-1843.2010.01713.x.

[69] Pifarré, Fernando, Diego Dulanto Zabala, Gonzalo Grazioli, and Ignasi de Maura. "COVID-19 and Mask in Sports." Apunts Sports Medicine 55, no. 208 (December 2020): 143–45. https://doi.org/10.1016/j.apunsm.2020.06.002.

breathing rate.[70, 71] A mask intervention study in 53 employed neurosurgeons wearing surgical masks demonstrated a decrease in O2 saturation and an increased heart rate, even worse in the second hour than the first.[38] I mention this as I have worked in the operating room with surgeons and typically they say they notice no difference with a mask.[72] However, the objective data shows otherwise. Please remember masks are worn by all workers in a Canadian operating room, but primarily to reduce secretions or spittle contacting an open wound. These masks do nothing for minimizing viral spread. In addition in hospital the recommendation is to change masks every hour or so. This is hardly ever done in a place of business or in schools. A wet mask is much worse than any mask or no mask.

The documented surgical mask-induced changes in blood gases of increased CO-2 (hypercapnia) and decreased O2 (hypoxia) may result in mental confusion, decreased thinking ability and disorientation.[73, 74, 75, 76] Masks also interfere with the field of vision and non-verbal

[70] Georgi, Christian, Anja Haase-Fielitz, Daniel Meretz, Linda Gäsert, and Christian Butter. "The Impact of Commonly-Worn Face Masks on Physiological Parameters and on Discomfort During Standard Work-Related Physical Effort." Deutsches Aerzteblatt Online 117 (2020): 674–75. https://doi.org/10.3238/arztebl.2020.0674.

[71] Kyung, Sun Young, Yujin Kim, Hyunjoong Hwang, Jeong-Woong Park, and Sung Hwan Jeong. "Risks of N95 Face Mask Use in Subjects With COPD." Respiratory Care 65, no. 5 (May 2020): 658–64. https://doi.org/10.4187/respcare.06713.

[72] Beder, A., Ü. Büyükkoçak, H. Sabuncuoğlu, Z.A. Keskil, and S. Keskil. "Preliminary Report on Surgical Mask Induced Deoxygenation during Major Surgery." Neurocirugía 19, no. 2 (April 2008): 121–26. https://doi.org/10.1016/s1130-1473(08)70235-5.

[73] Johnson, Arthur T. "Respirator Masks Protect Health but Impact Performance: a Review." Journal of Biological Engineering 10, no. 4 (February 9, 2016). https://doi.org/10.1186/s13036-016-0025-4.

[74] Elisheva, Rosner. "Adverse Effects of Prolonged Mask Use among Healthcare Professionals during COVID-19." Journal of Infectious Diseases and Epidemiology 6, no. 3 (June 1, 2020). https://doi.org/10.23937/2474-3658/1510130.

[75] Azuma, Kenichi, Naoki Kagi, U. Yanagi, and Haruki Osawa. "Effects of Low-Level Inhalation Exposure to Carbon Dioxide in Indoor Environments: A Short Review on Human Health and Psychomotor Performance." Environment International 121 (December 2018): 51–56. https://doi.org/10.1016/j.envint.2018.08.059.

[76] Drechsler, Michael, and Jason Morris. "Carbon Dioxide Narcosis." National Center for Biotechnology Information. U.S. National Library of Medicine, February 21, 2021. https://pubmed.ncbi.nlm.nih.gov/31869084/.

and verbal communication. [77, 78, 79, 80, 81] Do we want our children in schools or pre-school to wear masks when there are relatively no benefits, but numerous risks and harmful consequences?

The mask-induced adverse changes are relatively minor at first glance but repeated exposures over longer periods are also relevant. Consider retail store workers, health care workers, teachers and many others who are currently wearing masks for 6-12 hours a day for 5-6 days a week. This will aggravate and create additional high blood pressure, atherosclerosis, including heart disease, metabolic syndrome and neurological diseases. In neurologic concerns think of headaches, fainting, epilepsy and reduced cognitive function.

Chris Schaefer, a 27-year experienced expert in Occupational Health and Safety, from Edmonton, demonstrated in a report and accompanying video (which I have carefully read and watched) prepared at the request of Mr. Dominic Desjarlais, lawyer, the oxygen and carbon dioxide level changes from the wearing of several types of masks.[82] In my opinion, this report is powerfully persuasive of the dangers of wearing masks, especially in any work or schooling environment where people are wearing masks for longer periods of time. We can see in the video that the changes in carbon dioxide occur within a minute and continue to climb to dangerous carbon dioxide levels which creates a real and present hazard for the health of anybody wearing a mask.

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[77] Rebmann, Terri, Ruth Carrico, and Jing Wang. "Physiologic and Other Effects and Compliance with Long-Term Respirator Use among Medical Intensive Care Unit Nurses." American Journal of Infection Control 41, no. 12 (December 1, 2013): 1218–23. https://doi.org/10.1016/j.ajic.2013.02.017.

[78] Spitzer, Manfred. "Masked Education? The Benefits and Burdens of Wearing Face Masks in Schools during the Current Corona Pandemic." Trends in Neuroscience and Education 20 (September 2020): 100138. https://doi.org/10.1016/j.tine.2020.100138.

[79] Heider, Claudia A., Matías L. Álvarez, Eduardo Fuentes-López, Claudia A. González, Norma I. León, Daniela C. Verástegui, Pedro I. Badía, and Carla A. Napolitano. "Prevalence of Voice Disorders in Healthcare Workers in the Universal Masking COVID-19 Era. "The Laryngoscope 131, no. 4 (October 2, 2020). https://doi.org/10.1002/lary.29172.

[80] Roberge, Raymond J, Jung-Hyun Kim, and Aitor Coca. "Protective Facemask Impact on Human Thermoregulation: An Overview." The Annals of Occupational Hygiene 56, no. 1 (January 2012): 102–12. https://doi.org/10.1093/annhyg/mer069.

[81] Palmiero, Andrew J., Daniel Symons, Judge W. Morgan, and Ronald E. Shaffer. "Speech Intelligibility Assessment of Protective Facemasks and Air-Purifying Respirators." Journal of Occupational and Environmental Hygiene 13, no. 12 (June 30, 2016): 960–68. https://doi.org/10.1080/15459624.2016.1200723.

[82] Report dated June 7, 2021 and accompanying video prepared by Chris Schaefer for Mr. Dominic Desjarlais.

Our body is exquisitely sensitive to this increased CO_2 as it quickly dissolves in the blood as carbonic acid. It is the sudden change in acidity (hydrogen ion increase) which triggers the next breath. If we are unable to achieve a good next breath, we rapidly experience "air hunger". Soon, both anxiety and even panic occur. This is exactly why a cloth over the nose and mouth with water poured over it (water boarding) is a frightening experience and a very successful torture technique. The change in oxygenation is especially common in young children as they have a higher metabolic rate (and associated higher CO_2 production).

All cloth masks become wet in 30-60 minutes as we continuously breathe out water vapour. It is very easy to consider the consequence of panic and fear, especially in a young child. If we ignore this I suggest long term PTSD (Post Traumatic Stress Disorder) and anxiety disorders are inevitable. Hospital workers and personnel use masks but change them very often and are very aware of how to do this optimally through repetitive training. This does not happen in the public and often will not happen in children. This is another important reason against a mask mandate in children.

The ultimate crisis from face masks is sudden death, which has been seen in five children worldwide when exercising or stressed with a mask.[83, 84, 85, 86, 87, 88]

[83] Karvounides, Dina, Maya Marzouk, Alexandra C. Ross, Juliana H. VanderPluym, Christina Pettet, Ali Ladak, Jason Ziplow, et al. "The Intersection of COVID-19, School, and Headaches: Problems and Solutions." Headache: The Journal of Head and Face Pain 61, no. 1 (December 31, 2020): 190–201. https://doi.org/10.1111/head.14038.

[84] Schwarz, Silke, Ekkehart Jenetzky, Hanno Krafft, Tobias Maurer, and David Martin. "Corona Children Studies 'Co-Ki': First Results of a Germany-Wide Registry on Mouth and Nose Covering (Mask) in Children," April 28, 2021. https://doi.org/10.21203/rs.3.rs-124394/v2.

[85] "Tragisch: Starb Schülerin in Deutschland Wegen Masken-Pflicht?" Wochenblick, September 8, 2020. https://www.wochenblick.at/tragisch-starb-schuelerin-in-deutschland-wegen-masken-pflicht/.

[86] Salo, Jackie. "Two Boys Drop Dead in China While Wearing Masks during Gym Class." New York Post. New York Post, May 6, 2020. https://nypost.com/2020/05/06/two-boys-drop-dead-in-china-while-wearing-masks-during-gym-class/.

[87] The Jakarta Post. "Youth Deaths in China during Gym Exams Put Focus on Mask Policy." The Jakarta Post, May 11, 2020. https://www.thejakartapost.com/news/2020/05/11/youth-deaths-in-china-during-gym-exams-put-focus-on-mask-policy.html.

[88] Pifarré, Fernando, Diego Dulanto Zabala, Gonzalo Grazioli, and Ignasi de Maura. "COVID-19 and Mask in Sports." Apunts Sports Medicine 55, no. 208 (December 2020): 143–45. https://doi.org/10.1016/j.apunsm.2020.06.002.

The following is a direct quote from myself in the second "Canadian Doctors Speak Out to Protect Kids" video[89]:

"As a physician with over 40 years of experience, including decades as an anesthesiologist, I have cared for newborns, children and adults. I am a parent and a grandparent, so I too, have "skin in the game".

As an anesthesiologist, I am acutely aware of the short-term harm that masks can cause. In a few minutes, air inside the mask decreases in oxygen by 15% (similar to being at high altitude). This alone triggers cognitive or thinking problems, headaches, drowsiness and fainting, and can even lead to developmental harm in kids' brains.

In addition, all masks trap the carbon dioxide we breathe out. It goes to 7-10 times the suggested NIOSH / OSHA guidelines for a work environment within minutes. This is most dramatic in children, as they have a higher metabolic rate. This is even more dramatic in an exercising or anxious or frightened child. Higher carbon dioxide blood levels result in an increased risk of sudden cardiac arrythmia. Why? Because high carbon dioxide increases the irritability of the heart electrical cycle, it can cause ventricular fibrillation, and even death. There are 5 world-wide deaths of children related to wearing masks with exercise or stress. This is madness.

Carbon dioxide controls our breathing and signals to our body to take the next breath. To experience this, close your mouth, hold your nose and hold your breath. Quite soon, you will gasp for another breath. We call this "air hunger" and is a huge protective mechanism of our well-being. Children who experience this "air hunger" are often told by adults to ignore it and leave the mask on. Why are we exposing our young children to this risk?

I suggest that children under 14 should never wear a mask and that no one of any age should wear a mask while exercising. In Sweden, children younger than 14 years old

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[89] "Canadian Doctors Speak Out to Protect Kids." Canada Health Alliance. Canada Health Alliance, May 2021. https://www.canadahealthalliance.org/?fbclid=IwAR34cR0vyNDXEKEofQOCGiBFIj1KlFxBGSXIebEiXgi2Jb cZNdaxm_sc1sM.

do not wear masks, and it was reported that the teachers were the healthiest professionals of all.

In summary, face masks are a "false god", and should be voluntary only when you are sick and cannot stay home. Masks create much more harm than good."

Table 1
Physiological and Psychological Effects of Wearing Facemask and Their Potential Health Consequences.

Physiological Effects	Psychological Effect	Health Consequences
• Hypoxemia • Hypercapnia • Shortness of breath • Increase lactate concentration • Decline in pH levels • Acidosis • Toxicity • Inflammation • Self-contamination • Increase in stress hormones level (adrenaline, noradrenaline and cortisol) • Increased muscle tension • Immunosuppression	• Activation of "fight or flight" stress response • Chronic stress condition • Fear • Mood disturbances • Insomnia • Fatigue • Compromised cognitive performance	• Increased predisposition for viral and infection illnesses • Headaches • Anxiety • Depression • Hypertension • Cardiovascular disease • Cancer • Diabetes • Alzheimer disease • Exacerbation of existing conditions and diseases • Accelerated aging process • Health deterioration • Premature mortality

Table 2: Physiological and Psychological Effects of Wearing Facemask and Their Potential Health Consequences[38]

The use of cloth masks is especially dangerous for all items in Table 2 from Vainshelboim 2020. Furthermore, an RCT (Randomized Control Trial) over four weeks compared cloth face masks, medical masks and no masks on the incidence of clinical respiratory illness, influenza-like illness, and laboratory confirmed respiratory virus illness among 1,607 participants.[90] There was no difference found. However, a large harmful effect with more than **thirteen times higher**

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[90] MacIntyre, C. R., H. Seale, T. C. Dung, N. T. Hien, P. T. Nga, A. A. Chughtai, B. Rahman, D. E. Dwyer, and Q. Wang. "A Cluster Randomised Trial of Cloth Masks Compared with Medical Masks in Healthcare Workers." BMJ Open 5, no. 4 (2015). https://doi.org/10.1136/bmjopen-2014-006577.

risk for influenza-like illness was found in wearers of cloth masks. This study concluded that cloth masks have significant health and safety issues.

4. Psychological effects of face masks

Wearing a face mask has negative psychological effects on both the wearer and nearby persons. Basic interpersonal connections through facial expression are much reduced.[91, 92, 93] Social connections and relationships are basic human needs. If these are insufficiently met, both poor mental and physical health result.[94, 95]

Wearing masks entails a feeling of deprivation of freedom and loss of autonomy and self-determination. This can lead to suppressed anger and subconscious constant distraction, especially as the wearing of masks is mostly dictated and ordered by others.[96, 97] Masks frequently cause anxiety and psychological vegetative stress reactions in children and adults. This increases psychosomatic and stress-related illnesses and depressive self-experience, reduced participation, social withdrawal and lowered health-related self-care.[98] The same paper shows over 50% of the mask wearers studied had at least mild depressive feelings.

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[91] Schneiderman, Neil, Gail Ironson, and Scott D. Siegel. "Stress and Health: Psychological, Behavioral, and Biological Determinants." Annual Review of Clinical Psychology 1, no. 1 (2005): 607–28. https://doi.org/10.1146/annurev.clinpsy.1.102803.144141.

[92] Thoits, Peggy A. "Stress and Health: Major Findings and Policy Implications." Journal of Health and Social Behavior 51, no. 1_suppl (2010). https://doi.org/10.1177/0022146510383499.

[93] Haslam, Nick. "Dehumanization: An Integrative Review." Personality and Social Psychology Review 10, no. 3 (2006): 252–64. https://doi.org/10.1207/s15327957pspr1003_4.

[94] Cohen, Sheldon. "Social Relationships and Health." American Psychologist 59, no. 8 (2004): 676–84. https://doi.org/10.1037/0003-066x.59.8.676.

[95] Leigh-Hunt, N., D. Bagguley, K. Bash, V. Turner, S. Turnbull, N. Valtorta, and W. Caan. "An Overview of Systematic Reviews on the Public Health Consequences of Social Isolation and Loneliness." Public Health 152 (2017): 157–71. https://doi.org/10.1016/j.puhe.2017.07.035.

[96] Rains, Stephen A. "The Nature of Psychological Reactance Revisited: A Meta-Analytic Review." Human Communication Research 39, no. 1 (January 1, 2013): 47–73. https://doi.org/10.1111/j.1468-2958.2012.01443.x. https://www.medrxiv.org/content/10.1101/2020.04.26.20080911v2.

[97] Matusiak, Łukasz, Marta Szepietowska, Piotr Krajewski, Rafał Białynicki-Birula, and Jacek C. Szepietowski.

"Inconveniences Due to the Use of Face Masks during the COVID-19 Pandemic: A Survey Study of 876 Young People." Dermatologic Therapy 33, no. 4 (August 28, 2020). https://doi.org/10.1111/dth.13567.

[98] Prousa, Daniela. "Studie Zu Psychischen Und Psychovegetativen Beschwerden Mit Den Aktuellen Mund-Nasenschutz-Verordnungen." PsychArchives. PsychArchives, January 2020. https://www.psycharchives.org/handle/20.500.12034/2751.

In addition, the mask has been transferred into a symbol of conformity and pseudo-solidarity. This increases the stress in those not wearing mask for a valid medical reason, which further divides and isolates people.

Further evidence of the importance of high or significant social connection was demonstrated in a meta-analysis of 91 studies of about 400,000 people. Folks with low contact frequency showed a 13% increased mortality risk.[99] Another meta-analysis of 148 prospective studies (308,849 participants) found that poor social relationships were associated with a 50% increased mortality risk. This increased mortality risk was comparable to smoking and exceeded both obesity and inactivity as risk factors.[100] These findings were consistent across ages, sex, initial health status, cause of death and follow-up periods. In short, this is extremely important to all of us. A further umbrella review of 10 meta-analyses showed increased risk of all-cause mortality, depression, anxiety, suicide, cancer and overall physical illness.[99]

From another perspective, please appreciate the changes in physiology due to facemasks that trigger our stress response – think adrenalin, cortisol and other stress hormones. The repeated, or stress-fear response over many hours, triggers the body to react in survival or "fight and flight" mode. This causes sustained increases in blood pressure, excess inflammation and suppression of the immune system.[67, 68] This of course, interferes with the body's ability to cope with a viral infection such as SARS-CoV-2.

VIII. Conclusions

In the foregoing, I have outlined the following key points:

1. The real nature and risks of COVID-19: it does not constitute a serious threat, whether real or imminent, for the greater majority of the population.

2. The optimal assessment of the quality of scientific or medical evidence regarding masks.

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[99] Shor, Eran, and David J. Roelfs. "Social Contact Frequency and All-Cause Mortality: A Meta-Analysis and Meta-Regression." Social Science & Medicine 128 (2015): 76–86. https://doi.org/10.1016/j.socscimed.2015.01.010.

[100] Holt-Lunstad, Julianne, Timothy B. Smith, and J. Bradley Layton. "Social Relationships and Mortality Risk: A Meta-Analytic Review." PLoS Medicine 7, no. 7 (2010). https://doi.org/10.1371/journal.pmed.1000316.

3. That the evidence in favour of the wearing of masks is only observational and there are no Random Controlled Trials (RCTs) and therefore, no Meta-analyses thereof, whereas the evidence against the wearing of masks is substantial and is based on RCTs and meta-analyses.

4. That the problems with masks are confirmed in a series of RCTs.

5. Mask problems reveal:

> i) No masks (surgical, N-95 or cloth) prevent virus transmission. In fact, they probably increase risk to the wearer and the people around them.

> ii) Within minutes, the mask wearer's carbon dioxide climbs to quite unhealthy levels, and oxygen levels decrease, also with health consequences.

> iii) Masks create headaches and cognitive impairment.

> iv) Anxiety and stress are triggered by wearing masks, especially in children.

6. In my opinion, in over 40 years as a physician, and decades as an anesthesiologist, when one considers the risk-benefit ratio for masks:

> i) The risk of major illness or death in children due to COVID-19 is almost zero.

> ii) Masks are not effective in preventing COVID-19 transmission and may worsen the transmission.

> iii) Masks elevate carbon dioxide and lower oxygen blood concentrations within minutes. This reduces cognitive capability, interferes with learning, increases anxiety and may even cause arrhythmias and even sudden death.

Therefore, in my opinion, as a result of studying the scientific literature and in view of my professional experience, masks create much more harm than benefit, especially in children. Hence, any mask mandate should be immediately rescinded.

William E Code

Signed June 10, 2021, Duncan, BC, Canada

From:	Crain, Krista (DH/MS) on behalf of Shephard, Dorothy Hon. (DH/MS)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Continuous masking in schools
Date:	April 6, 2022 9:41:50 AM

-----Original Message-----
From: 21(1)
Sent: Tuesday, April 5, 2022 10:53 AM
To: Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>
Subject: Continuous masking in schools

ATTENTION! External email / courriel externe.

Hi Dorothy,

I'm quite sure you're getting lots of these emails, regarding requests for continuous masking in schools. Please add my name to the long list of parents and professionals who have grave concerns regarding the current state of affairs, regarding guidance on masking, staying home while ill, and protecting not only our hospitals but our vulnerable.

Advocates against mask use make statements regarding the impact on speech and language development and their impact on mental health. To date, these arguments have not been supported by data. True disruptions to learning by having teachers out, children out, and parents who may become sick, disabled, or die from COVID-19 are real threats to the learning and mental health of children.

Children who are medically fragile, who have disabilities, neurodevelopmental disorders, or who may have any number of conditions that often first present in childhood including diabetes or asthma, are at increased risk for more problematic outcomes should they contract Covid-19. Recent estimates suggest that 1 in 4 children who do contract Covid-19 will have lasting effects, or Long Covid symptoms post-acute illness. Our children do not deserve the risks that they are being subjected to.

As you are likely well aware, multiple layers of protection, including vaccinations (which are at a staggeringly low level in our 5-11 age group), masks, ventilation, and staying at home when sick are our best weapons against illness. I ask that you pressure the leaders at public health to resume their responsibilities to manage this pandemic that is, unfortunately, not over.

Best regards,
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From:	Crain, Krista (DH/MS) on behalf of Shephard, Dorothy Hon. (DH/MS)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Please NO masks in schools! Pleading parent
Date:	April 6, 2022 9:45:21 AM

From: 21(1)

Sent: Tuesday, April 5, 2022 9:08 AM

To: Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>; Hogan, Bill Hon. (JPS/JSP) <Bill.Hogan@gnb.ca>; Cardy, Dominic Hon. (EECD/EDPE) <Dominic.Cardy@gnb.ca>; Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>

Subject: Please NO masks in schools! Pleading parent

ATTENTION! External email / courriel externe.

Good day,

I write to you today due to the rumour of masks going back in school. I beg of you not to proceed with that change. My child begs of you to leave leave the masks off. I cannot imagine how hard this change has been for some who are very scared much like they cannot believe how hard the past couple year have been for my child. Throughout the past few weeks being mask free at school the light in my child has finally coming back on. For the better part of two years I have had a depressed little boy who cried daily going to school, who shut down and hated every second of anything related to it which killed my soul.

Since opening up and removing masks he is a whole new kid. He is happier, he is no longer crying daily at drop off and begging me to pick him up so he doesn't have to go to daycare. It was absolutely 100% due to the masking because those are gone, the world is brighter and his attitude about life has changed for the better. He felt trapped, claustrophobic, sickly, the way he describes it he felt his individuality and identity was gone. I know this sounds dramatic but it is the truth he is someone who just cannot take it. He is almost 7 years old and doesn't have a clue how fun school is supposed to be which I am not sure if that's a blessing or a curse because he doesn't know yet really what he is missing. School for him is really the only place he would get to see friends and grow socially through the pandemic and we were all failing him.

Please I beg of you to leave it how it is. Those who are comfortable taking the risks can continue to be mask free and those who are scared or nervous and maybe for completely valid reasons can continue to mask. I personally am compromised and unable (medically) to get a second dose so of course I was a little bit nervous but my child's mental well-being needs to be my priority! We all had COVID in my family earlier this calendar year and it wasn't fun, and I understand it could have been worse, but I would take that many times over instead of seeing the sad state of children's mental health.

The reality is that this is airborn as has been discussed by medical professionals and masks have to come off throughout the day to eat and drink, kids are in small shared rooms all day, and kids don't wear them right either. I see this daily at the schools. Teachers and students are handling them, putting them random unsanitary places, and they are handled so much it is totally negating the effectiveness of them if there even is much with cloth masks that majority wear. I would send 15-20 per day and my son might wear 4-5 so more than most and each one would come home so disgusting that I cannot imagine that was ever on his face.

Our children are the future, our children need to see us take action that supports people of all kinds

not just one group and our children really need to see the path forward and some normalcy before we start losing them to other health crisis'. We all need our path forward, we need to up our game in cleanliness and personal hygiene, we need to stay away from others if feeling even slightly unwell, businesses need to be accepting/understanding of missed time due to illness and more than anything we need to move forward and learn to love one another and respect personal choices again and live with COVID.

Thank you for reading this.

Sincerely,

21(1)

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Mask mandate
Date:	April 6, 2022 11:15:41 AM

Please prepare a response for the Premier's signature.

Thank you,

Sheri Forsythe
Correspondence Coordinator/Coordinatrice de la correspondance
Office of the Premier/Cabinet du premier ministre

-----Original Message-----
From: 21(1)
Sent: Wednesday, April 6, 2022 11:06 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Mask mandate

ATTENTION! External email / courriel externe.

Dear Mr Higgs,

With all of the talk I am seeing regarding the few people opposing the removal of masks within the school system and childcare facilities, I feel the need to send you this correspondence in order for the voices of actual parents in NB to be heard. Unfortunately the news is only focused on the people wanting these masks back and the voices of MANY parents are being ignored. WE DO NOT AGREE!

As a parent of 2 girls, 4 and 8, I will tell you that the day masks were removed in schools was one of the most joyous days for these 2 girls. To be able to finally see their friends and family's smiling again after almost 2 years and feeling like life was going back to what a childhood should look like was joy in their hearts.
It's been 3 weeks, I don't see any unusual or flagging problems regarding Covid and schools. Why is this being brought up?

Where is the logic behind masking kids in school but yet they are free to mingle with friends after schools, sports activities, trampoline parks, bday parties etc without masks??? How is the school setting more at risk? If a doctor could explain this logically to me please.

All I ask is that you keep your promise to the NB people and NOT put this back in force. It is not fair to always be targeting children only. It does not make sense to mask only them. If you are to implement mandatory masks it should be for the public as well. But then Mr. Higgs, if you do this, when does it end? Will it ever end?
We need to stop pretending that Covid will disappear… it won't, we need to start living with this virus like many others.

Our children deserve to be able to go back to normal and to keep it this way.

I thank you for taking the time to read my note and hope you take this into consideration.

21(1)
Rothesay, NB

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Dr Russell
Date:	April 7, 2022 7:59:44 AM

Thank you,

Sheri Forsythe

Correspondence Coordinator/Coordinatrice de la correspondance

Office of the Premier/Cabinet du premier ministre

From: 21(1)

Sent: Wednesday, April 6, 2022 6:59 PM

To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>

Subject: Dr Russell

ATTENTION! External email / courriel externe.

Please see that Dr. Russell gets this.

I have 5 grandkids in public school and it is cruel and unusual punishment to make them ware masks for the sake of a few over cautious individuals.

I fully support her stand on no masking in schools.

Thank you

Sent from Mail for Windows

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From:	FTB Correspondence (FTB/FCT)
To:	DH Correspondence / Correspondance MS (DH/MS)
Cc:	Higgs, Premier Blaine (PO/CPM)
Subject:	FW: Question
Date:	April 14, 2022 4:11:50 PM
Attachments:	image001.png

Good Afternoon,

I have been advised that this would be for your department to respond.

Thanks so much!

Katharine Sedgwick
Administrative Assistant
Corporate Services | Division des services généraux
Finance and Treasury Board | Finances et Conseil du Trésor
506-457-7377 | katharine.sedgwick@gnb.ca
Get vaccinated against COVID-19 to help our province get back to normal.
Book now at gnb.ca/COVID19vaccine or call 1-833-437-1424. #SleevesUpNB
Faites-vous vacciner contre la COVID-19 pour que nous puissions revenir à la normale.
Prenez un rendez-vous maintenant sur le site gnb.ca/vaccinCOVID19 ou appelez
le 1-833-437-1424. #RelevonsnosmanchesNB

From: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Sent: Thursday, April 14, 2022 3:49 PM
To: FTB Correspondence (FTB/FCT) <FTB.Correspondence@gnb.ca>
Subject: FW: Question
Please prepare a response for the Premier's signature.
I am sending this to FTB as per Erika Jutras's statement that they are looking into options for an independent review of the pandemic response, but if you think it should go to Health instead, just let me know.
Thank you,
Emily Wilcox
Records Coordinator/Coordinatrice des documents
Office of the Premier/Cabinet du premier ministre

From: 21(1)
Sent: Thursday, April 14, 2022 3:39 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Question

ATTENTION! External email / courriel externe.

To the Honorable Mr. Blaine Higgs
I was wondering if there is a process in which the provincial government must prove and justify the decisions that

were made in regards to the implementation of the state of emergency, and all of the subsequent restrictions that were enacted and enforced?

Yale university conducted the largest study in the world regarding mask effectiveness. 350,000 participants and at the conclusion of the study it was determined that masks were ineffective at reducing the spread of covid 19. The best mask available, the n95, isn't even capable of stopping the virus from spreading. The evidence behind the mask mandates seem to be as leaky as the masks themselves. We also endured different forms of lockdowns and once again there is no evidence to support them. Full lockdowns, partial lockdowns, or circuit breakers have no basis in science. In fact a prominent university, John Hopkins university, released a study that says lockdowns had little to no effect on the virus. But it most certainly had an effect on the mental and financial wellbeing of most people. Instead we decided to follow the lead of communist China and enter into lockdowns. Furthermore vaccine mandates were implemented all the while knowing that there was no science to justify it. It was simply a tool used to coerce people into taking the vaccine. Healthy people who had an extremely low risk of getting severely sick were being forced to take a vaccine that we don't have the data for. Will there be a public inquiry into the actions of this government and public health over the course of the last two years? Will the public have access to all of the information they had to make up these policies?

Thank you

21(1) ██████

██████████

Over to Health for response

Sheri

-----Original Message-----
From: 21(1) ████████████████████
Sent: Monday, April 18, 2022 9:58 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Masks in schools

ATTENTION! External email / courriel externe.

Good morning Mr. Higgs,

I'm hearing talk of masks returning to schools. I just want to put in my two cents- in that I think it is not the right decision. My son will not return to wearing a mask, regardless of mandates. He contracted covid at school when mask wearing was mandatory. So to me that speaks to the efficacy of masks in schools. Also it is worth mentioning that he was only symptomatic with covid for about a day. The benefits clearly do not outweigh the risks. My son is 5, he has allergies, he has sinus and upper respiratory issues that cause him to drool, and being in a wet mask is detrimental to his health. He will not be in a mask again. This redundancy needs to stop, at some point.

In case it is not clear, he will be done school immediately if mandatory masking returns. This is 100% a parent's choice. And considering MOST children are currently in school, not wearing masks, not CARRYING masks- seems to me the parents have spoken. So many children struggled in many ways while masking at school.

I am very hopeful our government continues to make the right decision where this is concerned. A piece of cloth with a minion on it is NOT going to stop covid, it's not going to protect my son or anyone around him.

Thank you

21(1) ██████████

Sent from my iPhone

302

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: No to reinstating mask mandates in school
Date:	April 18, 2022 2:00:01 PM

Over to Health for response
Sheri

From: 21(1)

Sent: Sunday, April 17, 2022 5:20 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: No to reinstating mask mandates in school

<mark>**ATTENTION! External email / courriel externe.**</mark>

Hello Mr. Higgs,

First, thank you for taking the time to read this email. I am requesting that as PM of NB you consider not to reinstate the mask mandates in the schools. I believe that the masks are their for those who need them, however I am not able to go back to masking my kids at school. My oldest had really bad headaches when masks were mandatory, to the pont that she would miss school because of feeling so I'll and sometimes was even feeling so I'll that she would vomit. This immediately went away once mask mandates were lifted - she no longer has these headaches, is able to stay and learn at school. For my youngest, she is waiting for assessment for ADHD, I can tell you that while mask mandates were in force, her behaviour issues were 10 fold. Once the mask mandates were lifted in March, we saw immediate improvement at school and at home - we felt like there was hope for some happiness and good days ahead. I have heard lately your statements are more researched and "pro choice" and I truly appreciate that. Also, since masks mandates have been lifted, my kids have lived a more normal life and have not gotten seriously I'll with Covid - I réalisé that possibly this is not everyone's experience - but I feel we assess our health risks responsibly and have succeeded to remain healthy. My children both take part in after school activities and we practice hand washing and staying home if we don't feel 100% but we do not wear masks. We even participate in a dance Competition as well as a Ringuette competition in Fredericton at the end of March with over 800 participants in each event and was able to feel normal and didn't catch Covid ourselves but know many who did and it was very mild such as a normal cold. Please Mr. Higgs, I truly fear for my kids' well being if we go back to masks - I have seen a huge improvement in their academics since the masks have been dropped and even their anxieties have been much less. If we go back, I think school for them will become the source again of fears, anxiety and their headaches/behaviour problems…. I beg of you to continue to lead us out of this pandemic so our economy/communities and most importantly our children can flourish again.

Please do not take their recommendations to reinstate the mask mandates if this is where it's going, I implore you, I beg of you.

https://www.cbc.ca/news/canada/new-brunswick/covid-19-new-brunswick-masks-school-youth-advocate-lamrock-report-pediatricians-letter-1.6420946?fbclid=IwAR1AqLuXJup4GBnuaqbdJcjI3I70X5JGGkjLn51mDCoHMbtXq585r2HEOgI

Sincerely

21(1)

<table>
<tr><td>From:</td><td>Russell, Dr. Jennifer (DH/MS)</td></tr>
<tr><td>To:</td><td>DH Correspondence / Correspondance MS (DH/MS)</td></tr>
<tr><td>Subject:</td><td>Fwd: Thank you for doing a good job</td></tr>
<tr><td>Date:</td><td>April 18, 2022 9:30:49 PM</td></tr>
</table>

Get Outlook for iOS

From: 21(1)

Sent: Monday, April 18, 2022 11:46:45 AM

To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>; Higgs, Hon. Blaine (PO/CPM) <Blaine.Higgs2@gnb.ca>

Cc: Arseneault, Guy (LEG) <Guy.Arseneault@gnb.ca>; Guitard, Daniel (LEG) <Daniel.Guitard@gnb.ca>; Legacy, René (LEG) <Rene.Legacy@gnb.ca>; Landry, Denis (LEG) <Denis.Landry2@gnb.ca>; Thériault, Isabelle (LEG) <Isabelle.Theriault@gnb.ca>; Mallet, Éric (LEG) <Eric.Mallet@gnb.ca>; Chiasson, Keith (LEG) <Keith.Chiasson@gnb.ca>; lisa.harris@gnb.ca <lisa.harris@gnb.ca>; Conroy, Michelle (LEG) <Michelle.Conroy@gnb.ca>; Jake.Stewart@gnb.ca <Jake.Stewart@gnb.ca>; Arseneau, Kevin (LEG) <Kevin.A.Arseneau@gnb.ca>; Bourque, Benoît (LEG) <Benoit.Bourque@gnb.ca>; Gauvin, Robert (LEG) <Robert.Gauvin@gnb.ca>; LeBlanc, Jacques (LEG) <Jacques.J.LeBlanc@gnb.ca>; Mitton, Megan (LEG) <Megan.Mitton@gnb.ca>; Melanson, Roger (LEG) <Roger.L.Melanson@gnb.ca>; Allain, Daniel Hon. (ELG/EGL) <Daniel.Allain@gnb.ca>; McKee, Robert (LEG) <Robert.McKee@gnb.ca>; Turner, Greg (LEG) <Greg.Turner@gnb.ca>; Steeves, Ernie Hon. (FTB/FCT) <Ernie.Steeves@gnb.ca>; Wilson, Sherry (LEG) <Sherry.Wilson@gnb.ca>; Fitch, Bruce Hon. (SD/DS) <Bruce.Fitch@gnb.ca>; Holland, Mike Hon. (DNRED/MRNDE) <Mike.Holland@gnb.ca>; Wetmore, Ross (LEG) <Ross.Wetmore@gnb.ca>; Scott-Wallace, Tammy Hon. (THC/TCP-WEB/EDF) <Tammy.Scott-Wallace@gnb.ca>; Crossman, Gary Hon. (ELG/EGL-RDC/SDR) <Gary.Crossman@gnb.ca>; Flemming, Hon. Hugh J. (JPS/JSP) <Hugh.Flemming@gnb.ca>; Savoie, Glen Hon. (IGA/MAI) <Glen.Savoie@gnb.ca>; Holder, Trevor Hon. (PETL/EPFT) <Trevor.Holder@gnb.ca>; Dunn, Arlene Hon. (DAA/MAA) <Arlene.Dunn@gnb.ca>; Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>; Oliver, Bill Hon. (LEG) <Bill.Oliver@gnb.ca>; Anderson-Mason, Andrea (LEG) <Andrea.AndersonMason@gnb.ca>; Bockus, Kathy (LEG) <Kathy.Bockus@gnb.ca>; Wilson, Mary Hon. (SNB) <Mary.Wilson@gnb.ca>; Austin, Kris (LEG) <Kris.Austin@gnb.ca>; Carr, Jeff (LEG) <Jeff.Carr@gnb.ca>; Coon, David (LEG) <David.Coon@gnb.ca>; Green, Jill Hon. (DTI/MTI) <Jill.Green@gnb.ca>; Cullins, Ryan (LEG) <Ryan.Cullins@gnb.ca>; Ames, Richard (LEG) <Richard.Ames@gnb.ca>; Hogan, Bill Hon. (JPS/JSP) <Bill.Hogan@gnb.ca>; Johnson, Margaret Hon. (DAAF/MAAP) <Margaret.Johnson@gnb.ca>; Chiasson, Chuck (LEG) <Chuck.Chiasson@gnb.ca>; D'Amours, Jean-Claude (LEG) <Jean-Claude.D'Amours@gnb.ca>; Landry, Francine (LEG) <Francine.Landry@gnb.ca>; LePage, Gilles (LEG) <Gilles.LePage@gnb.ca>; Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>

Subject: Thank you for doing a good job
ATTENTION! External email / courriel externe.

Dear Premier Higgs and MLAs,

Thank you for staying the course on not imposing a mask mandate on New Brunswick's school children.

My child was able to resume his public education as were many now that masks are back to being a parental choice.

I am extremely disturbed by the amount of paediatricians and media personalities who speak of a mask as if it's a "simple measure", just a harmless article of clothing like a pair of socks that has nothing but benefits and absolutely no harms. Thank you for considering those harms.

I can only conclude that many fearful and perhaps well meaning people are under what's known in psychological literature as "mass formation psychosis."

Thank you for not caving to it, in the face of media- induced pressure to reverse course.

I completely disagree that children should ever wear a mask, like Dr. Russell had stated to CBC in April 2020 "Masks should not be worn for extended periods of time" where she explained there were health risks in wearing them for longer than a 15 minute trip to the grocery store. Real health risks invoking trapped bacteria to your face, breathing problems and infections, etc.

I want to express my appreciation for your standing firm, evening if your reasoning is obviously different than mine, thank you. This is also the consensus among parents, as you would see if you walked into any school in the past month.

If you ever want NB to take masks seriously again, they need to be reserved as extreme response to an emergency and dire situation. The current situation doesn't warrant that.

I am thankful that harms are finally being taken into consideration by NB government.

21(1) ████████████████████████

Sent from my iPad

From:	Russell, Dr. Jennifer (DH/MS)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	Fwd: Masks
Date:	April 18, 2022 9:30:58 PM

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From: 21(1) ████████████████████
Sent: Monday, April 18, 2022 2:16:04 PM
To: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>
Subject: Masks

<mark>**ATTENTION! External email / courriel externe.**</mark>

No masks in school.

Thank you
Concerned Parent

Some extra research info for you also...

https://jessicar.substack.com/p/what-is-going-on-in-new-brunswick?s=r

From: 21(1)

To: Higgs, Premier Blaine (PO/CPM) [Blaine.Higgs@gnb.ca]; Arseneault, Guy (LEG)
[Guy.Arseneault@gnb.ca]; Guitard, Daniel (LEG) [Daniel.Guitard@gnb.ca]; Legacy, René (LEG) [Rene.Legacy@gnb.ca];
Landry, Denis (LEG) [Denis.Landry2@gnb.ca]; Thériault, Isabelle (LEG) [Isabelle.Theriault@gnb.ca]; Mallet, Éric (LEG)
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Michelle (LEG) [Michelle.Conroy@gnb.ca]; Jake.Stewart@gnb.ca [Jake.Stewart@gnb.ca]; Arseneau, Kevin (LEG)
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Arlene Hon. (DAA/MAA) [Arlene.Dunn@gnb.ca]; Shephard, Dorothy Hon. (DH/MS) [Dorothy.Shephard@gnb.ca]; Oliver, Bill
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[Bill.Hogan@gnb.ca]; Johnson, Margaret Hon. (DAAF/MAAP) [Margaret.Johnson@gnb.ca]; Chiasson, Chuck (LEG)
[Chuck.Chiasson@gnb.ca]; D'Amours, Jean-Claude (LEG) [Jean-Claude.D'Amours@gnb.ca]; Landry, Francine (LEG)
[Francine.Landry@gnb.ca]; LePage, Gilles (LEG) [Gilles.LePage@gnb.ca]

Subject: No masks in school

Date: Tuesday, April 19, 2022 08:25:36

_____

ATTENTION! External email / courriel externe.

It has come to my attention that their are people trying to reinforce masks in our schools and i
for one would like to voice my opinion and say i don't want my children to have to sit in school
for 8h a day and breath in their own carbon dioxide my family is verry comfortable with the no
mask policy and i understand that there are parents that still are scared that's fine wear your
masks but leave us alone and let us make our own decisions for our own children

Thank you

21(1)

From:	21(1)
To:	Higgs, Premier Blaine (PO/CPM) [Blaine.Higgs@gnb.ca]
Subject:	No school mandated mask
Date:	Tuesday, April 19, 2022 07:29:20

Hi

I am writing in concern to the reinstatement of the mask mandate for our children in school system. I do not believe it is in the best interest of our childrens health to proceed with this. We the parents feel it should be our choice as parents to make these decisions. If someone wants to wear a mask or mask their children, they are doing so. It is a normal human function to get sick and recover. This is how our bodies build immunities. I as a concerned parent do not agree with masking our children. This could potentially do more harm than good. It is a normal human function to breath oxygen and not carbon monoxide.   There is also an abundance of germs that get inhaled from being masked for several hours daily. Covid is here, we all know this. People are all learning to live with it. It is time to move forward! It is time to stop the political and government overreach. I a very concerned parent deny the reinstatement of mask mandates. We will not stand for this any longer!

Thank you for your time.

From: 21(1)
To:
Subject: No Mask Mandates
Date: Monday, April 18, 2022 19:11:06
_____

ATTENTION! External email / courriel externe.

Good evening,

I am writing in opposition to reinstating mask mandates in the province, especially in schools.

There are many studies that show children are the least impacted by Covid. Kids have only been negatively impacted by the mask mandates that were put in place.

As a concerned parent, I have seen first hand the negative impact it has on children. I will not have my child be forced to wear one again when it does not prevent the spread of Covid-19.

I fully believe that anyone who wishes to continue to wear one, they should be able to do so. I also believe if you don't want to wear one, that is your right not to and your choices should be respected.

Thank you,

21(1)

Sent from my iPhone

Get Outlook for iOS

From: 21(1)
Sent: Sunday, February 20, 2022 9:13:23 AM
To: Russell, Dr. Jennifer (DH/MS) <Jennifer.Russell@gnb.ca>
Subject: Level 1

ATTENTION! External email / courriel externe.

Dear Dr. Russell
I am writing as a concerned parent. Level 1 does nothing for our children being masked all day at school. 2 years ago the world health organization put out info how it isn't healthy for children to be masked and here we are 2 years later and you still want them masked. The mask causes greater concern for me then covid. So far since school started in September my child has been on a puffer .. antibiotics and nasal spray. She comes home everyday so stuffed up. Can you seriously tell me they are healthy for kids to wear?? The majority has done what was asked get vaccinated vaccinate our children even if we didn't want to why cause we believed you and thought things might change. Well now the majority is annoyed and sick of the bull crap. We did our part now do yours. If kids want to wear mask fine but give the kids an option in the gym for phys Ed class and outside. Would love to see this revision to level one. The majority that listened is fed up and obviously if people haven't got vaccinated yet they aren't going to no way you are changing their mind now so give it up and move on. My child says she doesn't want to go to school and wear a mask all day inside and out. She's 5 she is suppose to love school not cry because she doesn't want to be masked all day. You are causing these young children more mental health issues then you know and it's very sad. You are a mother think about it from a mother's point of view not a politicians
Thanks and please consider making this change to level 1 it's not asking that much and I know Mr Higgs has received other email from upset parents about the mask . Time to consider a revision to level 1 please I'm begging you. It's so sad when your child doesn't want to go to school. Sad world these little ones are growing up in

--
Sent from myMail for Android

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Mandates
Date:	February 22, 2022 3:57:50 PM

Please prepare a response for the Premier's signature.

Thank you,

Sheri Forsythe
Correspondence Coordinator/Coordinatrice de la correspondance
Office of the Premier/Cabinet du premier ministre

-----Original Message-----
From: 21(1)
Sent: Tuesday, February 22, 2022 3:49 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Mandates

ATTENTION! External email / courriel externe.

Mr Higgs,

These mandates need to stop!! Our kids need their lives back. They need to be able to go to school without the worry of wearing masks or not being able to participate in activities because of their vaccination status. So many kids are being bullied and losing friendships. All because they don't have a vaccination or because that may not being wearing a mask right. This needs to end NOW!!! If you had the slightest idea what it is like to watch a child's mental health deteriorate because of the madness you would understand the people and be a voice for us not against us. Just remember one thing, it was the people that voted you in and it will be the people that can make sure you don't get back in. Good day sir and may god bless

P.S I will be send this email everyday until I receive back a response. Eventually I will be in contact with the media to see if they can find out why elected officials won't respond to concerns of the public. I've have contacted 2 other conservative members with no response. Not going to look good for the conservatives when this is brought to the media.

From:	Crain, Krista (DH/MS) on behalf of Shephard, Dorothy Hon. (DH/MS)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Masking in schools
Date:	April 19, 2022 1:14:38 PM

From: 21(1) ████████████████████████

Sent: Monday, April 18, 2022 10:26 PM

To: Shephard, Dorothy Hon. (DH/MS) <Dorothy.Shephard@gnb.ca>

Subject: Masking in schools

ATTENTION! External email / courriel externe.

Mrs. Shephard,

I am writing to you this evening to voice my concerns about bringing masking back into the classrooms.

My 7 year old hates masks. She has cried to me umpteen times over the passed 2 plus years because of them. She has NO immune system anymore. Thankfully, after having a cold, strep throat and then another cold she is feeling good enough to go back to school again.

I refuse to let my child go to school and wear a mask over her face, for 6 hours a day, for NO good reason. There is zero scientific evidence that masking is safe for prolonged times, zero evidence they even work for children and zero evidence of long term health issues because of masking, except for suppressing our natural immune response. My child will not be a guinea pig for the government.

Our children do not deserve to be masked. Let them breathe!!

21(1) ████████
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██████████
██████

From:	Elliott, Jennifer (DH/MS)
To:	Donovan, Wendy (DH/MS); Clair, Suzanne (DH/MS)
Subject:	Fwd: studies on masks and emotion recognition
Date:	April 19, 2022 6:36:51 PM
Attachments:	studies on masks and emotion recognition.docx

Fyi

Get Outlook for iOS

From: Liston, Heidi (DH/MS) <Heidi.Liston@gnb.ca>
Sent: Tuesday, April 19, 2022 6:29:14 PM
To: Elliott, Jennifer (DH/MS) <Jennifer.Elliott@gnb.ca>; Chalifoux, Mathieu (DH/MS)
<Mathieu.Chalifoux@gnb.ca>
Subject: studies on masks and emotion recognition

Hello, I meant to share the list of studies I had pulled previously on emotion recognition and face
masks. Realize we are still pulling together in case we need to respond further and felt someone
else should have this list just in case.

Heidi

Masked education? The benefits and burdens of wearing face masks in schools during the current Corona pandemic

Manfred Spitzer [1]
Affiliations expand

Abstract

Face masks can prevent the spread of the virus SARS-CoV-2, in particular as this spread can occur from people with no symptoms. However, covering the lower half of the face reduces the ability to communicate, interpret, and mimic the expressions of those with whom we interact. Positive emotions become less recognizable, and negative emotions are amplified. Emotional mimicry, contagion, and emotionality in general are reduced and (thereby) bonding between teachers and learners, group cohesion, and learning - of which emotions are a major driver. The benefits and burdens of face masks in schools should be seriously considered and made obvious and clear to teachers and students. The school's specific situation must also inform any decision regarding face mask use.

"What Is Hidden behind the Mask?" Facial Emotion Recognition at the Time of COVID-19 Pandemic in Cognitively Normal Multiple Sclerosis Patients

[Stefano Ziccardi](#)[1], [Francesco Crescenzo](#)[2], [Massimiliano Calabrese](#)[1]
Affiliations expand

Free PMC article

Abstract

Social cognition deficits have been described in people with multiple sclerosis (PwMS), even in absence of a global cognitive impairment, affecting predominantly the ability to adequately process emotions from human faces. The COVID-19 pandemic has forced

people to wear face masks that might interfere with facial emotion recognition. Therefore, in the present study, we aimed at investigating the ability of emotion recognition in PwMS from faces wearing masks. We enrolled a total of 42 cognitively normal relapsing-remitting PwMS and a matched group of 20 healthy controls (HCs). Participants underwent a facial emotion recognition task in which they had to recognize from faces wearing or not surgical masks which of the six basic emotions (happiness, anger, fear, sadness, surprise, disgust) was presented. Results showed that face masks negatively affected emotion recognition in all participants ($p < 0.001$); in particular, PwMS showed a global worse accuracy than HCs ($p = 0.005$), mainly driven by the "no masked" ($p = 0.021$) than the "masked" ($p = 0.064$) condition. Considering individual emotions, PwMS showed a selective impairment in the recognition of fear, compared with HCs, in both the conditions investigated ("masked": $p = 0.023$; "no masked": $p = 0.016$). Face masks affected negatively also response times ($p < 0.001$); in particular, PwMS were globally hastier than HCs ($p = 0.024$), especially in the "masked" condition ($p = 0.013$). Furthermore, a detailed characterization of the performance of PwMS and HCs in terms of accuracy and response speed was proposed. Results from the present study showed the effect of face masks on the ability to process facial emotions in PwMS, compared with HCs. Healthcare professionals working with PwMS at the time of the COVID-19 outbreak should take into consideration this effect in their clinical practice. Implications in the everyday life of PwMS are also discussed.

Keywords: COVID-19; face masks; facial emotion recognition; multiple sclerosis; social cognition.

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Understanding the Impact of Face Masks on the Processing of Facial Identity, Emotion, Age, and Gender

Daniel Fitousi [1], Noa Rotschild [1], Chen Pnini [1], Omer Azizi [1]
Affiliations expand

- PMID: 34803825

Abstract

The COVID-19 pandemic has introduced new challenges for governments and individuals. Unprecedented efforts at reducing virus transmission launched a novel arena for human face recognition in which faces are partially occluded with masks. Previous studies have shown that masks decrease accuracy of face identity and emotion recognition. The current study focuses on the impact of masks on the speed of processing of these and other important social dimensions. Here we provide a systematic assessment of the impact of COVID-19 masks on facial identity, emotion, gender, and age. Four experiments (N = 116) were conducted in which participants categorized faces on a predefined dimension (e.g., emotion). Both speed and accuracy were measured. The results revealed that masks hindered the perception of virtually all tested facial dimensions (i.e., emotion, gender, age, and identity), interfering with normal speed and accuracy of categorization. We also found that the unwarranted effects of masks were not due to holistic processes, because the Face Inversion Effect (FIE) was generally not larger with unmasked compared with masked faces. Moreover, we found that the impact of masks is not automatic and that under some contexts observers can control at least part of their detrimental effects.

Keywords: COVID-19; face perception; masks; social perception; social perception masks and face perception.

The COVID-19 pandemic masks the way people perceive faces

[Erez Freud](#)[1], [Andreja Stajduhar](#)[2], [R Shayna Rosenbaum](#)[2 3], [Galia Avidan](#)[4 5], [Tzvi Ganel](#)[4]
Affiliations expand

Free PMC article

Abstract

The unprecedented efforts to minimize the effects of the COVID-19 pandemic introduce a new arena for human face recognition in which faces are partially occluded with masks. Here, we tested the extent to which face masks change the way faces are perceived. To this end, we evaluated face processing abilities for masked and unmasked faces in a large online sample of adult observers (n = 496) using an adapted version of the Cambridge Face Memory Test, a validated measure of face perception abilities in humans. As expected, a substantial decrease in performance was found for masked faces. Importantly, the inclusion of masks also led to a qualitative change in the way masked faces are perceived. In particular, holistic processing, the hallmark of face perception, was disrupted for faces with masks, as suggested by a reduced inversion effect. Similar changes were found whether masks were included during the study or the test phases of the experiment. Together, we provide novel evidence for quantitative and qualitative alterations in the processing of masked faces that could have significant effects on daily activities and social interactions.

Face masks disrupt holistic processing and face perception in school-age children

[Andreja Stajduhar](#)[1], [Tzvi Ganel](#)[2], [Galia Avidan](#)[3 2], [R Shayna Rosenbaum](#)[1 4], [Erez Freud](#)[5]
Affiliations expand

Abstract

Face perception is considered a remarkable visual ability in humans that is subject to a prolonged developmental trajectory. In response to the COVID-19 pandemic, mask-wearing has become mandatory for adults and children alike. Recent research shows that mask-wearing hinders face recognition abilities in adults, but it is unknown if the same holds true in school-age children in whom face perception is not fully developed. Here we tested children (n = 72, ages 6-14 years old) on the Cambridge Face Memory Test - Kids (CFMT-K), a validated measure of face perception performance. Faces were presented with or without masks and across two orientations (upright/inverted). The inclusion of face masks led to a profound deficit in face perception abilities. This decrement was more pronounced in children compared to adults, but only when task difficulty was adjusted across the two age groups. Additionally, children exhibited reliable correlations between age and the CFMT-K score for upright faces for both the mask and no-mask conditions. Finally, as previously observed in adults, children also showed qualitative differences in the processing of masked versus non-masked faces. Specifically, holistic processing, a hallmark of face perception, was disrupted for masked faces as suggested by a reduced face-inversion effect. Together, these findings provide evidence for substantial quantitative and qualitative alterations in the processing of masked faces in school-age children.

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Surgical face masks impair human face matching performance for familiar and unfamiliar faces

[Daniel J Carragher](#)[1], [Peter J B Hancock](#)[2]
Affiliations expand

Abstract

In response to the COVID-19 pandemic, many governments around the world now recommend, or require, that their citizens cover the lower half of their face in public. Consequently, many people now wear surgical face masks in public. We investigated whether surgical face masks affected the performance of human observers, and a state-of-the-art face recognition system, on tasks of perceptual face matching. Participants judged whether two simultaneously presented face photographs showed the same person or two different people. We superimposed images of surgical masks over the faces, creating three different mask conditions: control (no masks), mixed (one face wearing a mask), and masked (both faces wearing masks). We found that surgical face masks have a large detrimental effect on human face matching performance, and that the degree of impairment is the same regardless of whether one or both faces in each

pair are masked. Surprisingly, this impairment is similar in size for both familiar and unfamiliar faces. When matching masked faces, human observers are biased to reject unfamiliar faces as "mismatches" and to accept familiar faces as "matches". Finally, the face recognition system showed very high classification accuracy for control and masked stimuli, even though it had not been trained to recognise masked faces. However, accuracy fell markedly when one face was masked and the other was not. Our findings demonstrate that surgical face masks impair the ability of humans, and naïve face recognition systems, to perform perceptual face matching tasks. Identification decisions for masked faces should be treated with caution.

Keywords: Deep neural network; Face recognition; Familiarity; Identity verification; Signal detection theory.

(Un)mask yourself! Effects of face masks on facial mimicry and emotion perception during the COVID-19 pandemic

Till Kastendieck [1], Stephan Zillmer [1], Ursula Hess [1]
Affiliations expand

Abstract

Face masks have been said to impact face-to-face interaction negatively. Yet, there is limited evidence on the degree to which partial face occlusion is detrimental to empathic processes such as emotion perception and facial mimicry. To address this question, we conducted an online experiment (N=200, U.K. sample) that assessed

subjective ratings and facial expressions (mimicry) in response to masked and unmasked faces. Perceivers were able to recognise happiness and sadness in dynamic emotion expressions independent of (surgical) face masks. However, perceived emotion intensity and interpersonal closeness were reduced for masked faces. Facial mimicry, the perceiver's imitation of the expresser's emotional display, was reduced or absent in response to happy but preserved for sad mask-covered expressions. For happy target expressions, the face-mimicry link was partially mediated by perceived emotion intensity, supporting the idea that mimicry is influenced by context effects. Thus, these findings suggest that whether face masks impede emotion communication depends on the emotion expressed and the emotion-communication aspect of interest. With unprecedented changes in nonverbal communication brought about by the COVID-19 pandemic, this research marks a first contribution to our understanding of facial mimicry as an important social regulator during these times.

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The Effect of Surgical Masks on the Featural and Configural Processing of Emotions

[Natale Maiorana](#)[1], [Michelangelo Dini](#)[1], [Barbara Poletti](#)[2], [Sofia Tagini](#)[2], [Maria Rita Reitano](#)[3], [Gabriella Pravettoni](#)[4][5], [Alberto Priori](#)[1][3], [Roberta Ferrucci](#)[1][3][6]
Affiliations expand

Abstract

From the start of the COVID-19 pandemic, the use of surgical masks became widespread. However, they occlude an important part of the face and make it difficult to decode and interpret other people's emotions. To clarify the effect of surgical masks on configural and featural processing, participants completed a facial emotion recognition task to discriminate between happy, sad, angry, and neutral faces. Stimuli included fully visible faces, masked faces, and a cropped photo of the eyes or mouth region. Occlusion due to the surgical mask affects emotion recognition for sadness, anger, and neutral faces, although no significative differences were found in happiness recognition. Our findings suggest that happiness is recognized predominantly via featural processing.

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The impact of face masks on emotion recognition performance and perception of threat

[Melina Grahlow](#) [1 2 3], [Claudia Ines Rupp](#) [4], [Birgit Derntl](#) [1 3 5 6]
Affiliations expand

Abstract

Facial emotion recognition is crucial for social interaction. However, in times of a global pandemic, where wearing a face mask covering mouth and nose is widely encouraged to prevent the spread of disease, successful emotion recognition may be challenging. In the current study, we investigated whether emotion recognition, assessed by a validated emotion recognition task, is impaired for faces wearing a mask compared to uncovered faces, in a sample of 790 participants between 18 and 89 years (condition mask vs. original). In two more samples of 395 and 388 participants between 18 and 70 years, we assessed emotion recognition performance for faces that are occluded by something other than a mask, i.e., a bubble as well as only showing the upper part of the faces (condition half vs. bubble). Additionally, perception of threat for faces with and without occlusion was assessed. We found impaired emotion recognition for faces wearing a mask compared to faces without mask, for all emotions tested (anger, fear, happiness, sadness, disgust, neutral). Further, we observed that perception of threat was altered for faces wearing a mask. Upon comparison of the different types of occlusion, we found that, for most emotions and especially for disgust, there seems to be an effect that can be ascribed to the face mask specifically, both for emotion recognition performance and perception of threat. Methodological constraints as well as the importance of wearing a mask despite temporarily compromised social interaction are discussed.

How does the presence of a surgical face mask impair the perceived intensity of facial emotions?

[Maria Tsantani](#)[1], [Vita Podgajecka](#)[1], [Katie L H Gray](#)[2], [Richard Cook](#)[1 3]
Affiliations expand

Abstract

The use of surgical-type face masks has become increasingly common during the COVID-19 pandemic. Recent findings suggest that it is harder to categorise the facial expressions of masked faces, than of unmasked faces. To date, studies of the effects of mask-wearing on emotion recognition have used categorisation paradigms: authors have presented facial expression stimuli and examined participants' ability to attach the correct label (e.g., happiness, disgust). While the ability to categorise particular expressions is important, this approach overlooks the fact that expression intensity is also informative during social interaction. For example, when predicting an interactant's future behaviour, it is useful to know whether they are slightly fearful or terrified, contented or very happy, slightly annoyed or angry. Moreover, because categorisation paradigms force observers to pick a single label to describe their percept, any additional dimensionality within observers' interpretation is lost. In the present study, we adopted a complementary emotion-intensity rating paradigm to study the effects of mask-wearing on expression interpretation. In an online experiment with 120 participants (82 female), we investigated how the presence of face masks affects the perceived emotional profile of prototypical expressions of happiness, sadness, anger, fear, disgust, and surprise. For each of these facial expressions, we measured the perceived intensity of all six emotions. We found that the perceived intensity of intended emotions (i.e., the emotion that the actor intended to convey) was reduced by the presence of a mask for all expressions except for anger. Additionally, when viewing all expressions except surprise, masks increased the perceived intensity of non-intended emotions (i.e., emotions that the actor did not intend to convey). Intensity ratings were unaffected by presentation duration (500ms vs 3000ms), or attitudes towards mask wearing. These findings shed light on the ambiguity that arises when interpreting the facial expressions of masked faces.

To Mask or Not to Mask-Evaluation of Cognitive Performance in Children Wearing Face Masks during School Lessons (MasKids)

[Anne Schlegtendal](#)[1], [Lynn Eitner](#)[1], [Michael Falkenstein](#)[2], [Anna Hoffmann](#)[1], [Thomas Lücke](#)[1], [Kathrin Sinningen](#)[1], [Folke Brinkmann](#)[1]
Affiliations expand

Abstract

In the current SARS-CoV-2 pandemic, wearing a face mask is mandatory again during school lessons. There are no controlled studies in children to date indicating an effect on cognitive performance from wearing face masks. In a randomized controlled trial, we analysed the influence of face masks on cognitive performance of pupils during regular school lessons. Pupils (n = 133, fifth to seventh grade) were randomized by alternating allocation into control (with masks, n = 65) and intervention groups (without mask, n = 68). After two school lessons with (control) and without (intervention) face masks in class, all pupils performed digital tests for cognitive performance regarding attention and executive functions (switch, Corsi block-tapping, 2-back and flanker task). Overall, there were no significant differences in cognitive performance between both groups, masks vs. no masks. Wearing face masks has no significant influence on attention and executive functions of pupils and can still be recommended during school lessons.

Keywords: children; cognitive impairment; concentration; face masks; school.

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The impact of facemasks on emotion recognition, trust attribution and re-identification

[Marco Marini](#)[1 2], [Alessandro Ansani](#)[3 2], [Fabio Paglieri](#)[1], [Fausto Caruana](#)[4], [Marco Viola](#)[5]
Affiliations expand

Free PMC article

Abstract

Covid-19 pandemics has fostered a pervasive use of facemasks all around the world. While they help in preventing infection, there are concerns related to the possible impact of facemasks on social communication. The present study investigates how emotion recognition, trust attribution and re-identification of faces differ when faces are seen without mask, with a standard medical facemask, and with a transparent facemask restoring visual access to the mouth region. Our results show that, in contrast to standard medical facemasks, transparent masks significantly spare the capability to recognize emotional expressions. Moreover, transparent masks spare the capability to infer trustworthiness from faces with respect to standard medical facemasks which, in turn, dampen the perceived untrustworthiness of faces. Remarkably, while transparent masks (unlike standard masks) do not impair emotion recognition and trust attribution, they seemingly do impair the subsequent re-identification of the same, unmasked, face (like standard masks). Taken together, this evidence supports a dissociation between mechanisms sustaining emotion and identity processing. This study represents a pivotal

step in the much-needed analysis of face reading when the lower portion of the face is occluded by a facemask.

The Impact of Face Masks on the Emotional Reading Abilities of Children-A Lesson From a Joint School-University Project

Claus-Christian Carbon[1], Martin Serrano[2]
Affiliations expand

Free PMC article

Abstract

Wearing face masks has become a usual practice in acute infection events inducing the problem of misinterpreting the emotions of others. Empirical evidence about face masks mainly relies on adult data, neglecting, for example, school kids who firmly are dependent on effective nonverbal communication. Here we offer insights from a joint school-university project. Data indicate that emotional reading of 9 to 10 years old pupils (N = 57) was similarly impaired as adults on an overall performance level, but that their selective performance on specific emotions was quite different. Kids showed extreme problems in reading the emotion disgust, strong effects on fear and sadness,

and only mild effects on happiness, but also even better performances for emotional states anger and neutral when faces were masked. This project did gain not only relevant data about children's perception but also made clear how fruitful seriously conducted school projects can be to encourage the interest and commitment for Science, Technology, Engineering, and Mathematics (STEM)-relevant topics.

Keywords: COVID-19; STEM; children; emotional states; face masks; intersectional school–university projects.

Reading Covered Faces

[Marina A Pavlova](#)[1], [Arseny A Sokolov](#)[2]
Affiliations expand

Abstract

Covering faces with masks, due to mandatory pandemic safety regulations, we can no longer rely on the habitual daily-life information. This may be thought-provoking for healthy people, but particularly challenging for individuals with neuropsychiatric and neurodevelopmental conditions. Au fait research on reading covered faces reveals that: 1) wearing masks hampers facial affect recognition, though it leaves reliable inferring basic emotional expressions; 2) by buffering facial affect, masks lead to narrowing of emotional spectrum and dampen veridical evaluation of counterparts; 3) masks may affect perceived face attractiveness; 4) covered (either by masks or other veils) faces have a certain signal function introducing perceptual biases and prejudices; 5) reading covered faces is gender- and age-specific, being more challenging for males and more variable even in healthy aging; 6) the hampering effects of masks on social cognition occur over the globe; and 7) reading covered faces is likely to be supported by the large-scale assemblies of the neural circuits far beyond the social brain. Challenges and

limitations of ongoing research and parallels to the Reading the Mind in the Eyes Test are assessed. Clarification of how masks affect face reading in the real world, where we deal with dynamic faces and have entrée to additional valuable social signals such as body language, as well as the specificity of neural networks underlying reading covered faces calls for further tailored research.

Keywords: aging; brain communication; covered faces; cultural differences; development; emotion; face mask; face reading; gender and sex; neural circuits; neuropsychiatric conditions; nonverbal visual social cognition; social brain; social distancing.

Face masks reduce emotion-recognition accuracy and perceived closeness

Felix Grundmann[1], Kai Epstude[1], Susanne Scheibe[1]
Affiliations expand

Abstract

Face masks became the symbol of the global fight against the coronavirus. While face masks' medical benefits are clear, little is known about their psychological

consequences. Drawing on theories of the social functions of emotions and rapid trait impressions, we tested hypotheses on face masks' effects on emotion-recognition accuracy and social judgments (perceived trustworthiness, likability, and closeness). Our preregistered study with 191 German adults revealed that face masks diminish people's ability to accurately categorize an emotion expression and make target persons appear less close. Exploratory analyses further revealed that face masks buffered the negative effect of negative (vs. non-negative) emotion expressions on perceptions of trustworthiness, likability, and closeness. Associating face masks with the coronavirus' dangers predicted higher perceptions of closeness for masked but not for unmasked faces. By highlighting face masks' effects on social functioning, our findings inform policymaking and point at contexts where alternatives to face masks are needed.

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Masking of kids
Date:	April 20, 2022 7:38:27 AM

For Department's response.

Thank you,

Sheri Forsythe
Correspondence Coordinator / Coordinatrice de la correspondance
Office of the Premier/Cabinet du premier ministre

-----Original Message-----
From: 21(1)
Sent: Wednesday, April 20, 2022 7:26 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Masking of kids

ATTENTION! External email / courriel externe.

Hi Blaine

There are many different articles about the harm of masking is doing to our children. Specially went the affect of Covid is so minor when it comes to kids.

Covid just went through my house a month ago and we have 4 children under 8 and every one made out fine.

So as I am sure you can tell I am against masking my kids to go to school … specially since every where else in the world Covid is over.

So let's move on so our NB kids can see others smiling faces

21(1)

For Department's response.

Thank you,

Sheri Forsythe
Correspondence Coordinator / Coordinatrice de la correspondance
Office of the Premier/Cabinet du premier ministre

-----Original Message-----
From: 21(1)
Sent: Tuesday, April 19, 2022 6:08 PM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: School masks

ATTENTION! External email / courriel externe.

Mr Higgs ;
I am strongly opposed to and do not want the school mask mandates for the children in the province of NB nor any other province for that matter .I believe that forcing children to wear masks is child abuse . Many well informed doctors and scientists are declaring that the masks do not work.

Thank you kindly
21(1)

From:	Higgs, Premier Blaine (PO/CPM)
To:	DH Correspondence / Correspondance MS (DH/MS)
Subject:	FW: Mask mandates
Date:	April 20, 2022 8:27:59 AM

Guess we are going to be getting a lot of emails on this subject matter.
Sheri

From: 21(1)
Sent: Wednesday, April 20, 2022 8:17 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: Mask mandates

ATTENTION! External email / courriel externe.

As the parent of a child in high school who has suffered immensely over the last 2 years, please do not reinstate mask mandates. Her mental health can not take it. Our province does not have the resources to support the mental health crisis

21(1)

Hi,

I understand that the vaccine has been made available and that many have taken this vaccine. It seems that this vaccine has not stopped transmission or the symptoms or effects of this virus. It seems as though those who have or have not gotten it considering health and age have been experiencing the same symptoms which seem to vary. I believe it should be up to an individual or the parent if individuals fall under 18 to mask or vax. This vax has not proven to help aid in the outbreak of covid-19. Politicians are not doctors. Doctors all over the world very renound doctors at that have stated the same advice as I have stated above. I have read and researched the 9 PAGES of negative side effects released from Pfizer. I am much more worried and concerned of the negative side effects of this experimental vaccine. Which it is because new info is being learned and recorded daily. So that falls under experimental. It is also stated on the side of masks box that they do not protect against covid. There is a very large overreach being done by the government and politicians in removing our rights of freedom of choice and I do not agree with these terms. Mask mandates can also cause harm for our children. I do not agree with making this mandatory in our schools again

On Wed., Apr. 20, 2022, 11:05 a.m. COVID-19 Public Enquiries / Demandes publiques COVID-19 (DH/MS), <COVID-19NB@gnb.ca> wrote:

> Good morning 21(1)
>
> Thank you for sharing your concerns.
>
> For almost two years, New Brunswick has been enforcing public health measures under a law meant to respond to emergencies. Two years ago, we had no vaccine, very little was known about COVID-19, and the circulating virus at that time was resulting in severe illness and high levels of hospitalization. That picture is much different today.
>
> Existing strategies remain effective to reduce transmission, and can be employed in all environments, including schools, as a part of a vaccine-plus approach, as required:
>
> - Putting some space between yourself and others, when able
>
> - Refreshing indoor air space by opening a window or door
>
> - Choosing to wear a multi-layer well-fitting mask
>
> - Washing or sanitizing hands frequently
>
> - Staying home and getting tested when symptomatic
>
> Please be aware, the situation is fluid and the information changes daily. We strongly encourage you to visit our dedicated COVID-19 website for the most current information:

www.gnb.ca/coronavirus .

Sincerely,

Department of Health COVID-19 Public Enquiries Team/ l'Équipe de demandes publiques COVID-19 du Ministère de la Santé

For the most up-to-date information, please visit our dedicated COVID-19 website/Pour obtenir les informations les plus récentes, veuillez visiter notre site Web dédié à la COVID-19:

www.gnb.ca/coronavirus

● Be Informed ● Be Safe ● Be Prepared ● Be Kind ●

● Soyez informé ● Soyez protégé ● Soyez préparé ● Soyez bienveillant ●

From: 21(1)
Sent: April 19, 2022 7:29 AM
To: Higgs, Premier Blaine (PO/CPM) <Blaine.Higgs@gnb.ca>
Subject: No school mandated mask

Hi

I am writing in concern to the reinstatement of the mask mandate for our children in school system. I do not believe it is in the best interest of our childrens health to proceed with this. We the parents feel it should be our choice as parents to make these decisions. If someone wants to wear a mask or mask their children, they are doing so. It is a normal human function to get sick and recover. This is how our bodies build immunities. I as a concerned parent do not agree with masking our children. This could potentially do more harm than good. It is a normal human function to breath oxygen and not carbon monoxide. There is also an abundance of germs that get inhaled from being masked for several hours daily. Covid is here, we all know this. People are all learning to live with it. It is time to move forward! It is time to stop the political and government overreach. I a very concerned parent deny the reinstatement of mask mandates.

We will not stand for this any longer!

Thank you for your time.