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PREDICTORS OF MASK WEARING TO PREVENT THE COMMUNITY SPREAD OF SARS-COV-2:

Who does not adhere to mask wearing measures, why and in what context?

A Rapid Evidence Assessment

April 2023

LONDON METROPOLITAN UNIVERSITY

UNICEF Innocenti – Global Office of Research and Foresight

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London Metropolitan University's Performance with Purpose Research Centre is located within the Guildhall School of Business and Law. The Centre focuses on research that addresses real societal challenges, such as inclusion, social value and equity, and applies business and management techniques to support effective organizational performance in tackling social problems. The research team was led by Dr. Stephen Hills and included Dr. Justin Webb, Dr. Anna Baker, Dr. Somayeh Pouransari and Alexandros Semertzi. For more information please visit: www.londonmet.ac.uk/research/centres-groups-and-units/performance-with-purpose-research-centre

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CONTENTS

EXECUTIVE SUMMARY

01

Background

Non-pharmaceutical interventions (NPIs) have played a critical role in reducing transmission rates and the impact of COVID-19 and will continue to be an important tool in slowing and preventing the spread of SARS-CoV-2. Despite effective vaccines being available since 2020, they have thus far been unable to eradicate COVID-19 due to variations in vaccine uptake, global inequities in vaccine access and the emergence of new variants. Therefore, NPIs, including mask wearing, have been retained as a protective measure against COVID-19.

Research questions

1. Who is more likely to not adhere to mask wearing measures?

2. Why are people more likely to not adhere to mask wearing measures?

3. In what context are people more likely to not adhere to mask wearing measures?

Conceptual framework

The COM-B model proposes that there are three components which play a pivotal role in producing behaviour and which, therefore, can be modified to change it. According to the model, in order to perform a behaviour, individuals must feel that they are physically and psychologically capable of performing it, have the physical and social opportunity to perform it and the motivation to perform it such that they want to or need to carry out the behaviour more than competing ones.

Methodology

A systematic search of the literature was undertaken to identify empirical research in journal articles written in English, published up to and including 30 June 2021, which investigated factors associated with mask wearing adherence to limit the spread of SARS-CoV-2. Keywords and search strings were designed and tested to capture this focus and a systematic search was undertaken in PubMed Central, Web of Science and Google Scholar, which returned 179 studies about mask wearing adherence. The returned articles underwent title, abstract and full text screening against the inclusion and exclusion criteria before a quality appraisal determined the final list of 16 unique studies to be included in this rapid evidence assessment (REA). These studies underwent thematic analysis to establish factors associated with mask wearing non-adherence before evidence was segmented by region, cultural groups and income of countries to establish the contexts in which factors were predictive of mask wearing non-adherence, using the COM-B model as a theoretical framework.

Who is more likely to not adhere to mask wearing measures and in what context?

Age: Age is not associated with mask wearing adherence [64 per cent of studies, 7 out of 11], as particularly evident in North American [75 per cent of studies, 6 out of 8] and Anglo cultural group [75 per cent of studies, 6 out of 8] countries.

Sex/gender: Males are more likely to not adhere to mask wearing measures than females [55 per cent of studies, 6 out of 11].

Education: People who are less educated are more likely to not adhere to mask wearing measures [57 per cent of studies, 4 out of 7], as particularly evident in high income countries [75 per cent of studies, 3 out of 4].

Income: Amount of income is not associated with mask wearing adherence [50 per cent of studies, 2 out of 4].

Race/ethnicity: Members of Black ethnic groups are most likely to wear a mask [60 per cent of studies, 3 out of 5].

Marital status: There is insufficient evidence to draw conclusions about the relationship between marital status and mask wearing adherence.

Living area: Whether someone is a rural or urban dweller is not associated with mask wearing adherence [50 per cent of studies, 2 out of 4].

Health status: There is insufficient evidence to draw conclusions about the relationship between health status and mask wearing adherence.

Access to health care: There is insufficient evidence to draw conclusions about the relationship between access to health care and mask wearing adherence.

Why are people more likely to not adhere to mask wearing measures and in what context?

Social opportunity: *External social opportunities required to make performing a behaviour possible, such as social pressures, cultural rules and expectations, and cultural perceptions.*

Perceived social normative pressure: People who perceive less social normative pressure to wear a mask are more likely to not adhere to mask wearing measures [86 per cent of studies, 6 out of 7], as particularly evident in North American [80 per cent of studies, 4 out of 5], Anglo cultural group [80 per cent of studies, 4 out of 5] and high income [83 per cent of studies, 5 out of 6] countries.

Political ideology: Right-wing or conservative voters are more likely to not adhere to mask wearing measures [100 per cent of studies, 5 out of 5], as particularly evident in North American [100 per cent of studies, 5 out of 5], Anglo cultural group [100 per cent of studies, 5 out of 5] and high income [100 per cent of studies, 5 out of 5] countries.

Setting: There is insufficient evidence to draw conclusions about the relationship between setting and mask wearing adherence.

Mandating mask wearing: There is insufficient evidence to draw conclusions about the relationship between mandating mask wearing and mask wearing adherence.

Reflective motivation: *The reflective and internal processes by which we evaluate existing situations, influencing our decision-making and thus behaviours.*

Perceived mask wearing efficacy: People who perceive mask wearing to be less effective are more likely to not adhere to mask wearing measures [60 per cent of studies, 3 out of 5], as particularly evident in North American [75 per cent of studies, 3 out of 4], Anglo cultural group [75 per cent of studies, 3 out of 4] and high income [75 per cent of studies, 3 out of 4] countries.

Perceived vulnerability to COVID-19: The relationship between perceived vulnerability to COVID-19 and mask wearing adherence is inconclusive [50 per cent of studies, 2 out of 4 found that, as perceived vulnerability increases, mask wearing non-adherence decreases; 50 per cent of studies, 2 out of 4 found that perceived vulnerability is not predictive of mask wearing adherence].

Perceived susceptibility to COVID-19: People who perceive themselves to be less susceptible to catching COVID-19 are more likely to not adhere to mask wearing measures [80 per cent of studies, 4 out of 5], as particularly evident in North American [75 per cent of studies, 3 out of 4], Anglo cultural group [75 per cent of studies, 3 out of 4] and high income [75 per cent of studies, 3 out of 4] countries.

Perceived behavioural control: People who perceive themselves to have less control over their mask wearing are more likely to not adhere to mask wearing measures [75 per cent of studies, 3 out of 4], as particularly evident in high income countries [75 per cent of studies, 3 out of 4].

Policy implications

Support males to wear masks: Further research is required to understand why males are more likely to not adhere to mask wearing measures in order to inform the design of interventions and policies that can support them to adhere to mask wearing measures.

Support less educated people to wear masks: Further research is required to understand why less educated people are more likely to not adhere to mask wearing measures in order to inform the design of interventions and policies that can support them to adhere to mask wearing measures.

Learn why members of Black ethnic groups are most likely to wear a mask, but least likely to receive the vaccine: Further research is required to understand why members of Black ethnic groups are most likely to wear a mask, but least likely to receive a COVID-19 vaccine (see equivalent

REA on vaccine hesitancy in this series), in particular with regard to perceived vulnerability, perceived susceptibility and trust.

Model mask wearing and make mask wearing a requirement in social settings: Community leaders should model mask wearing adherence to encourage members of their community to adhere to mask wearing measures. Furthermore, ambassadors from peer groups should be recruited to model mask wearing adherence for groups who are more likely to not adhere to mask wearing measures. Social normative pressure can be further strengthened by restricting access to social venues and social events to people not wearing a mask, although this carries a risk of politicizing COVID-19 and mask wearing.

Depoliticize COVID-19 and diversify messengers promoting mask wearing: Removal of freedoms can lead to a widening of the political divide and should be avoided wherever possible. Messengers should be diversified, using non-political figures, as well as right-wing and conservative leaders, to promote the importance of mask wearing.

Communicate how masks work and how effective they are: The role of masks in limiting the spread of COVID-19 should be clearly communicated. Source control to block exhaled COVID-19 virus is where, if someone has the virus, she or he can protect others by wearing a mask to block the release of up to 80 per cent of exhaled respiratory particles and droplets into the environment. Filtration for wearer protection is where, if someone comes into contact with the virus, wearing a mask can reduce her or his exposure to infectious particles and droplets, filtering nearly 50 per cent of fine particles. The effectiveness of face masks at limiting the release of the virus from the wearer, but also protecting them from exposure, has consistently been found to reduce transmission by approximately 70 per cent in real-world settings.

Challenge beliefs of insusceptibility to COVID-19 with real-time location-specific data: Regular and meaningful communication of infection rates can challenge perceptions of insusceptibility.

Provide free-of-charge masks and reminders to wear masks: Provide free-of-charge masks at entrances to locations where mask wearing is required or advised, and environmental cues, such as signs, to remind people to wear masks.

INTRODUCTION

02

Background

Non-pharmaceutical interventions (NPIs) have played a critical role in reducing transmission rates and the impact of COVID-19 and will continue to be an important tool in slowing and preventing the spread of SARS-CoV-2. Despite effective vaccines having been available since 2020, they have thus far been unable to eradicate COVID-19 due to variations in vaccine uptake, global inequities in vaccine access (1) and the emergence of new variants (2). Therefore, NPIs, including mask wearing, have been retained as a protective measure against COVID-19.

This REA seeks to understand and synthesize the existing evidence about who does not adhere to mask wearing measures, why and in what context. It focuses on non-adherence, rather than adherence, to be able to inform policies and interventions for those who require support to wear masks.

This report forms part of a larger evidence assessment to investigate NPIs or behavioural interventions to prevent the community spread of SARS-CoV-2, namely the delay or refusal of vaccination, social distancing and self-isolation.

Research questions

1. Who is more likely to not adhere to mask wearing measures?

2. Why are people more likely to not adhere to mask wearing measures?

3. In what context are people more likely to not adhere to mask wearing measures?

Conceptual framework

The COM-B model (3) was used as a conceptual framework for this REA. It proposes that there are three components which play a pivotal role in producing behaviour and which, therefore, can be modified to change it. According to the model, in order to perform a behaviour, such as the behaviour of mask wearing, an individual must feel that they are physically and psychologically capable of performing it, have the physical and social opportunity to perform it and the motivation to perform it such that they want to or need to carry out the behaviour more than competing ones, such as not adhering with mask wearing measures.

- **Capability:** Our abilities to perform a behaviour, including psychological capability, such as knowledge, and physical capability.

- **Opportunity:** External factors required to make performing a behaviour possible, including physical opportunities, such as being able to access a location, having the time and the resources, and social opportunities, such as social pressures, cultural rules and expectations, and cultural perceptions. Furthermore, opportunities may include campaigns or interventions (e.g., advertising campaigns) designed to encourage adherence.

- **Motivation:** Internal processes that influence our decision-making and thus behaviours, including reflective motivation, which covers the reflective processes whereby we evaluate existing situations, such as perceptions of the impact of the behaviour on oneself, and automatic motivation, such as desires and impulses.

METHODOLOGY

03

Systematic search

Inclusion criteria: The inclusion criteria are presented in Table 1 below. Only published academic journal articles are included in this REA, so that the evidence being rapidly assessed has first gone through the peer review process to pass an initial quality threshold. Only studies written in English are included, such that there may be relevant evidence published in non-English that is excluded in this review. Collection of evidence commenced on 30 June 2021, so any studies published after this date are excluded. This REA includes factors (e.g., demographics, capabilities, opportunities, motivations, campaigns) associated with the non-adherence (or conversely the adherence) of mask wearing measures. Studies about efficacy of masks are excluded, but studies about the efficacy of campaigns to increase mask wearing adherence are included, if available. Although there are pre-COVID-19 studies (e.g., SARS, Ebola, swine flu), in these contexts they are excluded and only ones in the context of COVID-19 are included. Study designs that are included are empirical research, whether quantitative or qualitative. Theoretical or conceptual studies are excluded, as are studies that lack explanation of the methodology used or which are secondary literature reviews (as opposed to systematic reviews or REAs). Systematic reviews or REAs are also excluded to avoid double review of studies included in the REA as independent studies.

Table 1: Inclusion criteria

	Inclusion criteria	Exclusion criteria
Publication format	Journal articles	Not journal articles Pre-prints
Language	English	Not in English
Publication date	Up to and including 30 June 2021	Post 30 June 2021
Aim of study	Investigating factors associated with mask wearing non-adherence (or conversely, mask wearing adherence) Efficacy of campaigns or interventions to tackle mask wearing non-adherence	Not investigating factors associated with mask wearing non-adherence (or conversely, mask wearing adherence) Efficacy of masks
Protective measure	Mask wearing	Not mask wearing

Virus	COVID-19	SARS Ebola Swine flu Not COVID-19
Study population	General population for a given territory Specific populations defined by demographic factors of ethnicity, gender OR age	Specific populations defined by factors other than demographic factors of ethnicity, gender OR age (e.g., hospital populations).
Study design	Empirical research (quantitative OR qualitative)	EITHER theoretical/conceptual OR lacking explanation of methodology OR secondary literature review OR systematic reviews OR REAs

Keywords and search strings: The following table provides a list of the keywords for the systematic search of studies via the study's title, abstract and keywords. Three layers of keywords are utilized so to reflect the inclusion criteria.

Table 2: Mask wearing keywords

Keywords 1	COVID; coronavirus
Keywords 2	Mask; face cover* [covering]
Keywords 3	Compl* [compliance/compliancy/comply/complied]; adher* [adherence/adherency/adhere/adhering/adhered]; follow* [following/followed]; rule* [rules]; guid* [guidelines/guided]; prevent* [preventative/preventing/prevented]; reason* [reasons]; associat* [associated/associations]; predict* [predictors/predicted]; expla* [explanatory/explained]; campaign* [campaigns]

The research team tested the keywords and search strings across the databases and found that they were effective at returning relevant evidence ahead of the full search commencing.

Databases: The research team undertook a comprehensive search of academic and open source databases, as listed in Table 3.

Table 3: List of databases searched

PubMed Central
Web of Science
Google Scholar

Screening

The following three-stage screening process was undertaken to determine the evidence to be included in the REA.

Title screening stage: The titles of studies returned by the systematic searches were screened for relevance using the inclusion criteria, and studies clearly not meeting the inclusion criteria, based upon the limited information available from a title, were excluded. Where a member of the research team was unsure about a study, it was discussed with a second member of the team to decide on inclusion (or not) in the next stage of screening.

Abstract screening stage: Of the remaining studies, their abstracts were next screened for relevance against the inclusion criteria, using the greater information available in an abstract such that it was possible to consider more of the inclusion criteria. Studies deemed not to meet the inclusion criteria were excluded. Again, where a member of the research team was unsure about a study, it was discussed with a second member of the team to decide on inclusion (or not) for the next stage of screening.

Full text screening stage: Of the remaining studies, they were read in full to determine if all inclusion criteria had been met and excluded if not. Where a member of the research team was unsure, a second member of the research team also read the full text. Both then discussed the study and came to a decision together on whether it should be included or excluded. The quality of a study was also appraised when reading the full text, considering guidance from the UK's Department for International Development (DFID, 4) on assessing the strengths of evidence.

Quality appraisal

According to DFID (4), judgement about a study's quality should be based upon a combination of criteria covering conceptual framing, transparency, appropriateness, cultural sensitivity, validity, reliability and cogency, as summarized and applied to this REA below:

Conceptual framing: The study should acknowledge existing research or theory, construct a conceptual or theoretical framework setting out the study's assumptions and pose specific research questions or hypotheses.

Transparency: The study should be transparent about its design and methods, including data collection and analysis and research setting, such that results can be reproduced. Studies receiving funding from a party with vested interests are considered fatally flawed and should be excluded from this REA.

Appropriateness: The study should use an appropriate research design to answer its research question or achieve its aim or objectives. The screening process will have included only studies investigating the factors associated with adherence of the included COVID-19 interventions. Experimental designs are most appropriate for establishing causal linkages between a treatment (e.g., campaign) and a dependent variable (e.g., adherence), but, other than campaigns, most factors (e.g., demographics, capabilities, opportunities and motivations) can only be measured and observed as independent variables, rather than manipulated or randomly assigned. As such, associations are most appropriately measured using observational designs, such as regression ones, that measure the association between factors and adherence whilst controlling for confounding variables to protect against bias whereby an unmeasured and uncontrolled variable can result in a distortion in the measurement of an association between a factor and adherence. Qualitative studies are not appropriate for measuring associations, but they are included in this REA because rich qualitative data can provide valuable evidence in terms of detailing the mechanisms and processes by which a factor is associated with adherence. Studies using an inappropriate design are considered fatally flawed and should be excluded from this REA.

Cultural sensitivity: The study should take steps to consider the local, socio-cultural factors that might affect the association between factors and adherence of mask wearing measures (i.e., are confounding variables). This is particularly important in the context of campaigns as treatment variables, where a control condition, in which the setting (i.e., socio-cultural factors) is held constant,

should be included as part of the design to isolate effect of a campaign from the setting in which it was implemented. Such measures are not possible when observing independent variables, but a study could theoretically consider socio-cultural factors when they represent a potential bias.

Validity: The study should take steps to ensure measurement validity, internal validity, external validity and ecological validity.

Measurement validity: The study should use indicators that are well suited to measure the target concept and which are valid in the research setting of the study. For example, using statements that measure the construct or variable of interest and using concrete facts (e.g., qualifications obtained to measure education), rather than abstract concepts where available.

Internal validity: The study should correctly interpret the extent to which its evidence establishes a cause and effect relationship. The study should take steps to control for confounding variables, which are possible in both experimental and observational designs. Furthermore, the study should take steps to consider reverse causality: the possibility that the supposed independent variable and supposed dependent variable are operating in reverse such that the supposed dependent variable is causing the supposed independent variable. For example, perceived susceptibility has been conceived as an independent variable in relation to the dependent variable of adherence to mask wearing measures, but equally, an individual's adherence to mask wearing measures can just as plausibly be an independent variable in relation to perceived susceptibility to COVID-19, i.e.,"I am not adhering to mask wearing measures so I am more susceptible to infection". An experimental design removes the possibility of reverse causality because the sequence of cause and effect can be observed following implementation of a treatment. However, reverse causality is a potential problem in observational research and where this is a risk it should be considered theoretically, i.e., provide an explanation based upon what we know about the variables to make a claim that one is causing the other.

External validity: The study should correctly interpret the extent to which its findings are likely to be generalizable and replicable across other contexts. Quantitative studies should take steps to construct a representative sample of the population of interest, such as using a sampling frame, randomly selecting responsive units from that sampling frame so that no units are systematically excluded, and collecting a sufficient sample size for appropriate margin of error and confidence level.

Ecological validity: The study should take steps to capture or accurately represent the real world by undertaking reflexivity to consider how much the activity of doing the research biased the research findings. For example, asking questions about legal adherence with measures in a way and in a context that captures the truth, rather than the socially desirable response.

Reliability: The study should take steps to ensure stability, internal reliability and analytical reliability.

Stability: The study should take steps to ensure that measures being used work consistently (i.e., results are stable under the same conditions), for example, by ensuring researchers are consistent in the way questions are asked and data gathered.

Internal reliability: The study should take steps to ensure internal consistency between different components of a measure. For example, Cronbach's Alpha can be used to measure the internal consistency of items comprising a scale and items from scales or variables removed from studies where internal consistency thresholds are not met.

Analytical reliability: The study should take steps to ensure that dramatically different results from the same set of data by different researchers or analytical steps being used are avoided. For example, using multiple researchers and using a coding scheme in thematic analysis.

Cogency: The study should provide a clear, logical thread that runs throughout the manuscript, linking conceptual frameworks to data collection, data analysis and conclusions, only making claims supported by the data and findings. Furthermore, the study should consider alternative explanations and interpretations of the data and findings and be self-critical such that limitations of the study are identified.

Where a member of the research team was unsure whether to include or exclude on the basis of quality, a second member of the research team undertook a quality appraisal of the study before both discussed to jointly reach a decision on inclusion.

Data analysis and synthesis

Predictors: Using NVivo software, open coding was undertaken to identify predictors of mask wearing non-adherence. Once all studies had been coded for predictors, lists of studies containing each predictor were established. At this point, predictors were reviewed to identify predictors of equivalent meaning but different labelling and these collapsed to form a single predictor. For example, it was decided that knowledge and belief in conspiracy theories were equivalent predictors.

Predictor-specific study summaries: Next, predictor-specific summaries of each study were written, identifying the study's context (e.g., United Kingdom residents), sampling method (e.g., convenience sample), how it defined and

measured the predictor, how it defined (e.g., mask wearing or face covering) and measured (e.g., binary variable; adherent or not) the outcome variable, the study design (e.g., cross-sectional survey design) and data analysis method (e.g., logistic regression). Next, a summary of the evidence relevant to the predictor of interest was written, which may have been quantitative or qualitative. Where the quantitative analysis was simple (e.g., Chi-square with a single independent variable), the summary described the relationship between the predictor and the outcome variable (e.g., percentage differences and statistical significance), but where it was multiple (e.g., multiple logistic regression) the summary described the relationship between the predictor and the outcome variable (e.g., odds ratio and statistical significance) when holding other variables constant. Finally, a conclusion was drawn as to the overall finding of the study in terms of the relationship between the predictor and the outcome variable.

This may have been identifying a category (e.g., males were most likely to not adhere to mask wearing measures) where the outcome variable was most prevalent, whether a numerical association was positive (e.g., as age increases, likelihood of not adhering to mask wearing measures increases), negative (e.g., as age increases, likelihood of not adhering to mask wearing measures decreases), non-linear or non-significant (e.g., there was no association between age and mask wearing adherence). Where there was conflicting evidence within a single study, the strength of the conflicting evidence was weighed up to determine an overall finding. For example, if the vast majority of predictor categories were not significantly associated with an outcome variable then that study would be deemed to be evidence that the predictor was not associated with the outcome variable.

Themes by finding: Next, the predictor-specific study summaries were thematically analysed on the basis of their findings. For example, studies were grouped on the basis of a positive association, negative association, non-linear association or no association.

Data synthesis: To draw conclusions for each predictor, frequencies of studies for each theme were counted and percentages calculated. This was done first at the level of predictive vs. non-predictive whereby, for example, studies finding statistically significant associations, regardless of the direction of the association, were grouped and counted and compared against all studies that did not find a statistically significant association between a predictor and outcome variable.

Next, this synthesis was undertaken at the granular level of themes, breaking predictive studies down into their different findings (e.g., positive association, negative association, non-linear association and no association). Where a category made up 70 per cent or above of the evidence it was deemed to yield a conclusion of high confidence about the relationship and where a category made up 60 to 69 per cent of the evidence it was deemed to yield a confident conclusion about the relationship. Where a category made up 50 to 59 per cent of the evidence it was deemed to yield a conclusion of some confidence about the relationship, unless another category also made up 50 per cent of the evidence, in which case the evidence was deemed inconclusive. Equally, if no categories made up at least 50 per cent of the evidence it was deemed inconclusive.

Context segmentation: To address the question 'in what contexts are people more likely to not adhere to mask wearing measures?' evidence was segmented on the basis of (i) region, (ii) cultural group and (iii) income, as determined by the country in which the study was conducted. Region segments used were Europe, North America, Asia, Oceania, South America and Africa. Cultural group segments used were Anglo, Germanic Europe, Nordic Europe, Eastern Europe, Latin Europe, Latin America, Southern Asia, Confucian Asia, Sub-Saharan Africa and the Middle East, as defined by House et al. (5). Income segments used were high income, upper middle income, lower middle income and low income, as defined by the World Bank. The above data synthesis approach was followed at the level of each segment. Where there were fewer than four studies in a segment, it was deemed that this was insufficient evidence by which to draw conclusions about the relationship between a predictor and outcome variable.

Themes by conceptual framework: Demographic predictors were identified so as to answer the 'who is more likely to not adhere to mask wearing measures' question. The remaining predictors were then organized within the COM-B model conceptual framework in terms of psychological capability (e.g., knowledge), physical capability (e.g., physical strength), physical opportunity (e.g., time, location and resources), social opportunity (e.g., cultural norms and social cues), reflective motivation (e.g., reflections and motivations) and automatic motivation (e.g., desires, impulses and inhibitions) to answer the 'why are people more likely to not adhere to mask wearing measures' question.

04

Systematic search and screening results

The systematic search returned 179 studies about mask wearing adherence (133 from Web of Science, 45 from Google Scholar and 1 from PubMed). After duplicates were removed on Zotero software, the number of studies decreased to 129.

Title screening stage: Of the 129 unique studies returned from the systematic search, 69 were excluded at the title screening stage:

- 69 studies were excluded for not being relevant: not measuring factors associated with mask wearing adherence.

Abstract screening stage: Of the 60 studies remaining after the title screening stage, 27 were excluded at the abstract screening stage:

- 27 studies were excluded for not being relevant: not measuring factors associated with mask wearing adherence.

Full text screening and quality appraisal stage: Of the 33 studies remaining after the abstract screening stage, 17 were excluded at the full text screening and quality appraisal stage:

- 10 studies were excluded for not being relevant: not measuring relevant outcomes.
- 5 studies were excluded for not being empirical research.
- 2 studies were excluded for being about too specific a population.

Overview of vaccine hesitancy evidence

The final list of mask wearing adherence evidence to be reviewed consisted of 16 studies, a summary of which follows:

Table 4: Summary of studies included in REA

	Study	Country	Region	Cultural Group	Income
1	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income
2	Pereira-Ávila et al. (2021)	Brazil	South America	Latin America	Upper Middle Income
3	van der Linden and Savoie (2020)	Canada	North America	Anglo	High Income
4	Chen et al. (2020)	China	Asia	Confucian Asia	High Income
5	Sun et al. (2021)	China	Asia	Confucian Asia	High Income
6	Al Naam et al. (2021)	Saudi Arabia	Asia	Middle East	High Income
7	Adjodah et al. (2021)	United States	North America	Anglo	High Income
8	Anderson and Stockman (2020)	United States	North America	Anglo	High Income
9	Barile et al. (2020)	United States	North America	Anglo	High Income
10	Cunningham and Nite (2021)	United States	North America	Anglo	High Income
11	Datta et al. (2021)	United States	North America	Anglo	High Income
12	Fisher et al. (2020)	United States	North America	Anglo	High Income
13	Hearne and Niño (2021)	United States	North America	Anglo	High Income
14	Mahalik et al. (2021)	United States	North America	Anglo	High Income
15	Milad and Bogg (2021)	United States	North America	Anglo	High Income
16	Stosic et al. (2021)	United States	North America	Anglo	High Income

Region: Evidence was reviewed from three regions of the world, the vast majority from North America [69 per cent] but also Asia [19 per cent] and South America [13 per cent]. There was no evidence from Europe, Oceania or Africa.

Cultural group: Evidence was reviewed from four cultural groups of the world, but dominated by evidence from the Anglo cultural group [69 per cent]. There was no evidence from the Germanic Europe, Nordic Europe, Eastern Europe, Latin Europe, Southern Asia and Sub-Saharan Africa cultural groups.

Income: The vast majority of evidence reviewed was from high income countries [88 per cent]. There was no evidence from lower middle income and low income countries.

Study design: All studies [100 per cent] followed a cross-sectional survey research design, which lends itself well to measuring factors associated with mask wearing non-adherence.

Table 5: Studies by region, cultural group, income category and study design

	Number	%
Region		
Europe	0	0%
North America	11	69%
Asia	3	19%
Oceania	0	0%
South America	2	13%
Africa	0	0%
Multi-regional	0	0%
Cultural Group		
Anglo	11	69%
Germanic Europe	0	0%
Nordic Europe	0	0%
Eastern Europe	0	0%
Latin Europe	0	0%
Latin America	2	13%
Southern Asia	0	0%
Confucian Asia	2	13%

Sub-Saharan Africa	0	0%
Middle East	1	6%
Multi-cultural group	0	0%
Income		
High Income	14	88%
Upper Middle Income	2	13%
Lower Middle Income	0	0%
Low Income	0	0%
Multi-incomes	0	0%
Study design		
Cross-sectional	16	100%
Conjoint experiment	0	0%
Qualitative	0	0%
Total	**16**	**100%**

WHO IS MORE LIKELY TO NOT ADHERE TO MASK WEARING MEASURES AND IN WHAT CONTEXT?

05

DEMOGRAPHICS
AGE

5.1.1

Age is the number of years since an individual was born. The evidence reviewed measured it as either discrete numerical data (i.e., the exact age in years of a respondent) or as a categorical variable (i.e., the age range group that a respondent's age corresponds to).

In total, 11 studies considered the association between age and mask wearing adherence. Of these, four found that age was predictive of mask wearing adherence and seven found that age was not associated with mask wearing adherence. Of the four studies that found age was predictive of mask wearing adherence, all found that, as age increases, mask wearing non-adherence increases (i.e., younger age groups are more likely to not adhere).

As age increases, mask wearing non-adherence decreases

Table 6: Studies evidencing that, as age increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Pereira-Ávila et al. (2021)	Brazil	South America	Latin America	Upper Middle Income
2	Al Naam et al. (2021)	Saudi Arabia	Asia	Middle East	High Income
3	Hearne and Niño (2021)	United States	North America	Anglo	High Income
4	Stosic et al. (2021)	United States	North America	Anglo	High Income

Brazil, Pereira-Ávila et al. (2021): The objective of the study by Pereira-Ávila et al. (2021) was to evaluate the practice of using face masks by the population of Paraíba, Brazil, during the COVID-19 pandemic. Using a cross-sectional descriptive-analytical design, Pereira-Ávila et al. (2021) assessed the outcome variable of face mask usage in 1,327 adult participants living in Paraíba against the independent variables of sex, age group, education, family income, marital status, hand washing and social isolation, using analysis of variance or the Student's t-test (social isolation and sex). Age was identified as a significant factor in mask wearing [$p < 0.01$] with use increasing with age; this was the case across settings: in health environments, the home environment and in public (mask usage was more likely in health environments and in public than in the home environment). During the time of the study, face mask use was recommended by the local and national authorities.

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimates (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported a significant difference in mask wearing in those aged 60 and above compared with a reference group of those under 30 years of age [OR: 1.95, $p < 0.01$].

United States, Stosic et al. (2021): Stosic et al. (2021) investigated whether a belief in science directly impacts reported face mask wearing in the United States. Using a cross-sectional survey design of 1,050 adult participants analysed using ordinal logistic regression controlling

for gender, race, ethnicity, region and political ideology, Stosic et al. (2021) report that age is a small but significant predictor of mask wearing, with mask wearing increasing as the age category increased [OR: 1.02, $p < 0.001$; age categories not reported].

Saudi Arabia, Al Naam et al. (2021): Al Naam et al. (2021) conducted a cross-sectional survey of adult Saudi residents (n = 3,572) to investigate the relationship between knowledge, attitudes and demographic factors, and compliance with the use of face masks. A one way analysis of variance identified a significant difference [$p < 0.001$] in reported compliance to mask wearing by age group (grouped in 10-year blocks: 16 to 24, 25 to 34 and so on), with a positive trend towards older age groups. A significant difference [$p < 0.001$] in positive attitudes towards mask wearing was also reported between age groups with increases, in the main, seen with increased age. Further, a significant difference [$p < 0.001$] was reported in the perceived barriers to mask wearing across age groups with a trend towards fewer perceived barriers as age increased. No difference in knowledge surrounding face mask wearing was reported by age group.

Age is not associated with mask wearing adherence

Table 7: Studies evidencing that age is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income
2	van der Linden and Savoie (2020)	Canada	North America	Anglo	High Income
3	Anderson and Stockman (2020)	United States	North America	Anglo	High Income
4	Barile et al. (2020)	United States	North America	Anglo	High Income
5	Cunningham and Nite (2021)	United States	North America	Anglo	High Income
6	Milad and Bogg (2021)	United States	North America	Anglo	High Income
7	Fisher et al. (2020)	United States	North America	Anglo	High Income

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed 15,507 observations, over an eight-week period, of adults wearing masks in outdoor recreational spaces while walking, running and cycling, collected just after a period of strict lockdown in Argentina. Regression analysis with face mask wearing as the outcome variable and with the predictors of time (week number within the observation period), activity, group size, estimated age and estimated gender showed that older adults were significantly more likely to wear a mask while walking [$\beta = 0.19$, $p < 0.001$] with no difference reported by age while running or cycling.

Freidin et al. (2021) also completed a survey of 578 respondents to assess the predictors of mask wearing using hierarchically organized regressions. The entering order of factors in the regression analysis was as follows: age, gender, education, contagion risk, illness severity, benefits (mask effectiveness), costs and norms. The model with the greatest predictive validity of variance included all of the aforementioned regression factors, explaining 39 per cent of the variance [$p < 0.001$]. Age explained 5 per cent of the variance in mask wearing but this was not significant.

Canada, van der Linden and Savoie (2020): Using a cross-sectional survey design with 2,194 participants stratified by age, sex, education, partisanship and region, van der Linden and Savoie (2020) assessed whether Canadians exhibit a higher propensity to wear masks in response to appeals to a sense of collective interest or self-interest. A linear regression model (including the categorical independent variables of sex, age group, highest level of educational attainment and vote choice in the 2019 Canadian federal election, as well as the impact of self or collective interest on mask wearing) found age to be a non-significant factor in predicting mask wearing.

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional

survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting the practice of wearing a face mask in public. Using stepwise backwards elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model; age was not found to be a significant predictor of mask wearing and was consequently removed from the final regression model.

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States (n = 1,004), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education), adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intention to use, or of use of, a face covering. Barile et al. (2020) report that age is not a predictor of intention to use, or of use of, a face covering of any kind.

United States, Cunningham and Nite (2021): Using data collected from secondary sources, Cunningham and Nite (2021) assessed the predictability of mask wearing in the United States from health behaviours, clinical care, environmental factors and socio-economic conditions, hypothesizing that, as these factors increase, so too would the use of face masks, assessed using regression modelling. Data concerning mask wearing were taken from a survey of 250,000 people with responses aggregated at the county level weighted by age, gender and zip code. Health data were taken from the County Health Rankings & Roadmaps website. Cunningham and Nite (2021) controlled for gender, ethnicity (White and non-White), setting (urban, rural) and voting preference. Age was not associated with mask wearing.

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Age was not correlated with adherence to mask wearing; a pathway model also did not find this to be a significant factor.

United States, Fisher et al. (2020): Fisher et al. (2020) surveyed a representative sample of adults (n = 1,005) in the United States in the month following the Government issuing recommendation to wear face coverings. The outcome of interest was the use of face coverings within the previous six weeks. No trend was evident in use by age, although the highest reported use was in the 30 to 39 age group at 84.4 per cent and the lowest in the 40 to 49 age group at 68 per cent. No statistical analysis was reported.

Conclusions

Table 8: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	As age increases, mask wearing non-adherence decreases [n, %]	As age increases, mask wearing non-adherence increases [n, %]		
Studies	4 [36%]		7 [64%]	11
Studies	4 [36%]	0	7 [64%]	11
Region				
Europe	0	0	0	0
North America	2 [25%]	0	6 [75%]	8
Asia	1 [100%]	0	0	1

Oceania	0	0	0	0
South America	1 [50%]	0	1 [50%]	2
Africa	0	0	0	0
Cultural Group				
Anglo	2 [25%]	0	6 [75%]	8
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	1 [50%]	0	1 [50%]	2
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	1 [100%]	0	0	1
Income				
High Income	3 [33%]	0	6 [67%]	9
Upper Middle Income	1 [50%]	0	1 [50%]	2
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Key

	Conclusion of high confidence
	Confident conclusion or conclusion of some confidence

Overall: Of the studies that considered the association between age and mask wearing adherence, 64 per cent [7 out of 11] found age to be non-predictive, such that it can be confidently concluded that age is not associated with mask wearing adherence. Of the four studies that found age to be predictive of mask wearing adherence, 100 per cent [4 out of 4] found that, as age increases, mask wearing non-adherence decreases (i.e., younger age groups are more likely to not adhere), such that it can be concluded with high confidence that, when age is predictive of mask wearing adherence, the association is negative. However, out of all the studies, only 36 per cent [4 out of 11] found that, as age increases, mask wearing non-adherence decreases (i.e., younger age groups are more likely to not adhere).

In looking for patterns by region, cultural group and income of the countries in the studies, some associations between age and mask wearing adherence are evident.

Region: Of the studies conducted in North American countries, 75 per cent [6 out of 8] found that age was not associated with mask wearing adherence, such that it can be concluded with high confidence that, in countries in

North America, age is not associated with mask wearing adherence.

There is insufficient evidence to draw conclusions about the relationship between age and mask wearing adherence in the contexts of South America [2 studies] and Asia [1 study].

There is no evidence to draw conclusions about the relationship between age and mask wearing adherence in the contexts of Europe [0 studies], Oceania [0 studies] and Africa [0 studies].

Cultural group: Of the studies conducted in countries in the Anglo cultural group, 75 per cent [6 out of 8] found that age is not associated with mask wearing adherence, so that it can be concluded with high confidence that, in countries in the Anglo cultural group, age is not associated with mask wearing adherence. There is insufficient evidence to draw conclusions about the relationship between age and mask wearing adherence in the contexts of the Latin America [2 studies] and Middle East [1 study] cultural groups.

There is no evidence to draw conclusions about the relationship between age and mask wearing adherence in the contexts of the Germanic Europe [0 studies], Eastern Europe [0 studies], Latin Europe [0 studies], Southern Asia [0 studies], Confucian Asia [0 studies] and Sub-Saharan Africa [0 studies] cultural groups.

Income: Of the studies conducted in high income countries, 67 per cent [6 out of 9] found that age is not associated with mask wearing adherence, so that it can be confidently concluded that, in high income countries, age is not associated with mask wearing adherence.

There is insufficient evidence to draw conclusions about the relationship between age and mask wearing adherence in the context of upper middle income countries [2 studies].

There is no evidence to draw conclusions about the relationship between age and mask wearing adherence in the context of lower middle income [0 studies] and low income [0 studies] countries.

DEMOGRAPHICS
SEX/GENDER

5.1.2

Sex is the biological characteristics and gender is the socially constructed characteristics of males, females and other categories. In the evidence reviewed sex and gender were most frequently measured as a binary variable (i.e., male vs. female), but also as a categorical variable with additional categories (e.g., other).

In total, 11 studies considered the association between sex/gender and mask wearing adherence. Of these, six found that sex/gender was predictive of mask wearing adherence and five found that sex/gender was not associated with mask wearing adherence. Of the six studies that found sex/gender was predictive of mask wearing adherence, all six found that males are more likely to not adhere to mask wearing than females.

Males are more likely to not adhere to mask wearing measures

Table 9: Studies evidencing that males are more likely to not adhere to mask wearing measures

	Study	Country	Region	Cultural Group	Income
1	Pereira-Ávila et al. (2021)	Brazil	South America	Latin America	Upper Middle Income
2	van der Linden and Savoie (2020)	Canada	North America	Anglo	High Income
3	Al Naam et al. (2021)	Saudi Arabia	Asia	Middle East	High Income
4	Hearne and Niño (2021)	United States	North America	Anglo	High Income
5	Mahalik et al. (2021)	United States	North America	Anglo	High Income
6	Stosic et al. (2021)	United States	North America	Anglo	Upper Middle Income

Brazil, Pereira-Ávila et al. (2021): The objective of the study by Pereira-Ávila et al. (2021) was to evaluate the practice of using face masks by the population of Paraíba, Brazil, during the COVID-19 pandemic. Using a cross-sectional descriptive-analytical design, Pereira-Ávila et al. (2021) assessed the outcome variable of face mask usage in 1,327 adult participants living in Paraíba against the independent variables of sex, age group, education, family income, marital status, hand washing and social isolation using analysis of variance or the Student's t-test (social isolation and sex). Sex was identified as a significant factor in mask wearing [$p < 0.01$], with females more likely to wear a mask than males. There was some variation across settings, with a significant difference reported in face mask use score in healthcare settings and in public (females again, more likely), but not in the home.

Canada, van der Linden and Savoie (2020): Using a cross-sectional survey design with 2,194 participants stratified by age, sex, education, partisanship and region, van der Linden and Savoie (2020) assessed whether Canadians exhibit a higher propensity to wear masks in response to appeals to a sense of collective interest or self-interest. A linear regression model (including the categorical

independent variables of sex, age group, highest level of educational attainment, and vote choice in the 2019 Canadian federal election, as well as the impact of self or collective interest on mask wearing) found that males were less likely than females to wear masks [OR: 0.593, $p < 0.01$].

Saudi Arabia, Al Naam et al. (2021): Al Naam et al. (2021) conducted a cross-sectional survey of adult Saudi residents (n = 3,572) to investigate the relationship between knowledge, attitudes and demographic factors, and compliance with the use of face masks. A one way analysis of variance identified significant differences in compliance to mask wearing by gender, with females more likely to wear a mask than males [$p < 0.001$].

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimates (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported that males were significantly less likely to wear a mask than females [OR: 0.69, $p < 0.01$].

United States, Mahalik et al. (2021): Mahalik et al. (2021) investigated the impact of conformity to masculine norms on attitudes to wearing a face mask. Mahalik et al. (2021) reported findings from an online survey of 596 male adults from the United States stating that greater conformity to male masculine norms results in a significant reduction in positive attitude towards use of face coverings [$B = -0.02$, $p < 0.001$]. This relationship was mediated by perceived benefits of mask wearing; those with high conformity were less likely to perceive benefits compared with those with low conformity to masculine norms, more likely to perceive barriers, and less likely to have confidence in science and empathy for vulnerable people.

United States, Stosic et al. (2021): Stosic et al. (2021) investigated whether a belief in science directly impacts reported face mask wearing in the United States and the mediating role of belief in mask effectiveness. Using a cross-sectional survey design of 1,050 adult participants analysed using ordinal logistic regression controlling for age, race, ethnicity, region and political ideology, Stosic et al. (2021) report gender to be a significant predictor of mask wearing, with males less likely to wear a mask than females [total effect – OR: 0.66, $p < 0.001$; direct effect – OR: 0.65, $p < 0.001$].

Sex/gender is not associated with mask wearing adherence

Table 10: Studies evidencing that sex/gender is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income
2	Chen et al. (2020)	China	Asia	Confucian Asia	High Income
3	Barile et al. (2020)	United States	North America	Anglo	High Income
4	Milad and Bogg (2021)	United States	North America	Anglo	High Income
5	Fisher et al. (2020)	United States	North America	Anglo	High Income

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed 15,507 observations, over an eight-week period, of mask wearing in outdoor recreational spaces while walking, running and cycling, collected just after a period of strict lockdown in Argentina. Regression analysis with face mask wearing as the outcome variable and with the predictors of time (week number within the observation period), activity, group size, estimated age and estimated gender showed that females were significantly more likely to wear a mask while walking [$\beta = 0.26$, $p < 0.001$) and running ($\beta = 0.25$, $p < 0.001$) but with no gender difference reported in mask wearing while cycling.

Freidin et al. (2021) also completed a survey of 578 respondents to assess the predictors of mask wearing using hierarchically organized regressions. The entering order of factors in the regressions was as follows: age, gender, education, contagion risk, illness severity, benefits (mask effectiveness), costs and norms. The model with the greatest predictive validity of variance reported by Freidin et al. (2021) included all of the aforementioned regression factors, explaining 39 per cent of the variance [$p < 0.001$]. Gender explained 3 per cent of the variance in mask wearing but this was not significant.

China, Chen et al. (2020): Chen et al. (2020) conducted a cross-sectional survey of 8,569 Chinese schoolchildren from 15 Wuhan primary schools in February 2020, to assess mask wearing and the socio-demographic factors influencing their use. A Chi-square test was used to identify significant independent variables (gender, grade, and mother's and father's occupations and education) for binary logistic regression analysis with odds ratios reported. Gender was not identified as a factor in mask wearing.

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States (n = 1,004), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education), adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intentions to use, and use of, a face covering. Females were identified as more likely to intend to wear a face mask [OR = 1.56, $p < 0.01$] but no differences were reported in actual use.

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Gender was not correlated with adherence to mask wearing; a pathway model also did not find this to be a significant factor.

United States, Fisher et al. (2020): Fisher et al. (2020) surveyed a representative sample of adults (n = 1,005) in the United States in the month following the government recommendation to wear face coverings. The outcome of interest was the use of face coverings within the previous six weeks. There was little difference between sexes/genders: males were slightly more likely to wear a mask than females [77.6 per cent vs. 75.3 per cent]. Statistical analysis was not reported.

Conclusions

Table 11: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	Males are more likely to not adhere to mask wearing [n, %]	Females are more likely to not adhere to mask wearing [n, %]		
Studies	6 [55%]		5 [45%]	11
Studies	6 [55%]	0	5 [45%]	11
Region				
Europe	0	0	0	0
North America	4 [57%]	0	3 [43%]	7
Asia	1 [50%]	0	1 [50%]	2
Oceania	0	0	0	0
South America	1 [50%]	0	1 [50%]	2
Africa	0	0	0	0

Cultural Group				
Anglo	4 [57%]	0	3 [43%]	7
Germanic Europe	0	0	0	0
Nordic Europe	o	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	1 [50%]	0	1 [50%]	2
Southern Asia	0	0	0	0
Confucian Asia	0	0	1 [100%]	1
Sub-Saharan Africa	0	0	0	0
Middle East	1 [100%]	0	0	1
Income				
High Income	5 [56%]	0	4 [44%]	9
Upper Middle Income	1 [50%]	0	1 [50%]	2
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the association between sex/gender and mask wearing adherence, 55 per cent [6 out of 11] found that sex/gender is predictive of mask wearing adherence, so that it can be concluded with some confidence that sex/gender is associated with mask wearing adherence. Of the six studies that found sex/gender to be predictive of mask wearing adherence, 100 per cent [6 out of 6] found that males are more likely to not adhere to mask wearing, so that it can be concluded with high confidence that, when sex/gender is predictive of mask wearing adherence, males are more likely to not adhere to mask wearing. However, out of all studies, only 55 per cent [6 out of 11] found males are more likely to not adhere to mask wearing, so that, overall, it can only be concluded with some confidence that males are more likely to not adhere to mask wearing.

In looking for patterns by region, cultural group and income of the countries in the studies, some associations between sex/gender and mask wearing adherence are evident.

Region: Out of studies conducted in North American countries, 57 per cent [4 out of 7] found that males were more likely to not adhere to mask wearing, so that it can be concluded with some confidence that, in North American countries, males are more likely to not adhere to mask wearing.

There is insufficient evidence to draw conclusions about the relationship between sex/gender and mask wearing adherence in the context of Asian [2 studies] and South American [2 studies] countries.

There is no evidence to draw conclusions about the relationship between sex/gender and mask wearing adherence in the contexts of European [0 studies], Oceanian [0 studies] and African [0 studies] countries.

Cultural group: Out of studies conducted in Anglo cultural group countries, 57 per cent [4 out of 7] found that males were more likely to not adhere to mask wearing, so that it can be concluded with some confidence that, in Anglo

cultural group countries, males are more likely to not adhere to mask wearing.

There is insufficient evidence to draw conclusions about the relationship between sex/gender and mask wearing adherence in the contexts of Latin American [2 studies], Confucian Asian [1 study] and Middle Eastern [1 study] cultural group countries.

There is no evidence to make conclusions about the relationship between sex/gender and mask wearing adherence in the contexts of Germanic European [0 studies], Nordic European [0 studies], Eastern European [0 studies], Latin European [0 studies], Southern Asian [0 studies] and Sub-Saharan African [0 studies] cultural group countries.

Income: Out of studies conducted in high income countries, 56 per cent [5 out of 9] found that sex/gender was not associated with mask wearing adherence so that it can be concluded with some confidence that, in high income countries, males are more likely to not adhere to mask wearing.

There is insufficient evidence to draw conclusions about the relationship between sex/gender and mask wearing adherence in the context of upper middle income countries [2 studies].

There is no evidence to draw conclusions about the relationship between sex/gender and mask wearing adherence in the contexts of lower middle income [0 studies] and low income [0 studies] countries.

DEMOGRAPHICS
EDUCATION

5.1.3

Education is the process of learning. Education was measured in terms of the highest level of formal education achieved by respondents as a categorical, but ordered, variable from low (e.g., no formal qualifications) to high (e.g., doctoral degree).

In total, seven studies considered the association between education and mask wearing adherence. Of these, five found that education was predictive of mask wearing adherence and two found that education was not associated with mask wearing adherence. Of the five studies that found education was predictive of mask wearing adherence, four found that, as education level increases, mask wearing non-adherence decreases (i.e., less educated people are more likely to not adhere) and one found that the relationship between education and mask wearing adherence was non-linear.

As education level increases, mask wearing non-adherence decreases

Table 12: Studies evidencing that, as education level increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Chen et al. (2020)	China	Asia	Confucian Asia	Upper Middle Income
2	Al Naam et al. (2021)	Saudi Arabia	Asia	Middle East	High Income
3	Anderson and Stockman (2020)	United States	North America	Anglo	High Income
4	Hearne and Niño (2021)	United States	North America	Anglo	High Income

China, Chen et al. (2020): Chen et al. (2020) conducted a cross-sectional survey of 8,569 Chinese schoolchildren from 15 Wuhan primary schools in February 2020, to assess mask wearing and the socio-demographic factors influencing their use. A Chi-square test was used to identify significant independent variables (gender, grade, mother's and father's occupations and education) for binary logistic regression analysis with odds ratios reported. No significant difference was reported between grades 1 to 2 and 3 to 4; however, those in grades 5 to 6 were significantly more likely to wear a face covering when compared with grades 1 to 2 as the reference group [OR: 1.21, $p < 0.05$]. Chen et al. (2020) also assessed the impact of parental education attainment on the mask wearing of their children; no significant association was reported in the father's educational attainment, however, the higher a mother's educational attainment, the greater the likelihood of mask wearing [OR: 1.87, $p < 0.05$, attainment of an undergraduate education compared with a reference value of primary or below; OR: 2.28, $p < 0.05$, attainment of postgraduate or above compared with a reference value of primary or below].

Saudi Arabia, Al Naam et al. (2021): Al Naam et al. (2021) conducted a cross-sectional survey of Saudi residents who were above 16 years of age and who had access to the internet; all Saudi residents who met these criteria were invited to participate, with 3,572 responses received. A one way analysis of variance reported statistically significant differences in compliance to mask wearing by level of education [$p < 0.001$], with those with a university and postgraduate education the most likely to wear a mask.

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting the practice of wearing a face mask in public. Using stepwise backwards elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model; those with a further education, having some trade or vocational schooling, or some college experience, were 3.5 times more likely to wear a face mask than those with a high school diploma, general equivalency diploma (GED), or less (reference category) [OR: 3.562, $p = 0.005$]; those with graduate schooling experience were 4.5 times more likely to wear a face mask than those with a high school diploma, GED, or less (reference category) [OR: 4.454, $p = 0.001$].

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimates (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported that those with lower levels of education [no high school diploma, OR: 0.90, not significant; high school diploma, OR: 0.70, $p < 0.05$; college education, OR: 0.74, $p < 0.05$] were less likely to wear a face covering compared with college graduates as the reference category.

Relationship between education and mask wearing adherence is non-linear

Table 13: Studies evidencing that the relationship between education and mask wearing adherence is non-linear

	Study	Country	Region	Cultural Group	Income
1	Pereira-Ávila et al. (2021)	Brazil	South America	Latin America	Upper Middle Income

Brazil, Pereira-Ávila et al. (2021): The objective of the study by Pereira-Ávila et al. (2021) was to evaluate the practice of using face masks by the population of Paraíba, Brazil, during the COVID-19 pandemic. Using a cross-sectional descriptive-analytical design, Pereira-Ávila et al. (2021) assessed the outcome variable of face mask usage in 1,327 adult participants living in Paraíba against the independent variables of sex, age group, education, family income, marital status, hand washing and social isolation using analysis of variance or the Student's t-test (social isolation and sex). Level of education was identified as a significant factor in mask wearing [$p < 0.01$]. However, the relationship was non-linear and there was no clear trend, with those with a postgraduate education most likely to wear a mask, those with just a primary education the next likely, then those with a high-school level education, and finally those with a graduate level education the least likely.

Education is not associated with mask wearing adherence

Table 14: Studies evidencing that education is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income
2	Milad and Bogg (2021)	United States	North America	Anglo	High Income

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed a survey of 578 adult respondents in Argentina to assess the predictors of mask wearing using hierarchically organized regressions. The entering order of factors in the regressions was as follows: age, gender, education, contagion risk, illness severity, benefits (mask effectiveness), costs and norms. The model with the greatest predictive validity of variance reported by Freidin et al. (2021) included all of the aforementioned regression factors, explaining 39 per cent of the variance [$p < 0.001$]. Education level was not a predictor of mask wearing.

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Education was not correlated with adherence to mask wearing; a pathway model also did not find this to be a significant factor.

Conclusions

Table 15: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]			Non-predictive [n, %]	Total
	As education level increases, mask wearing non-adherence decreases [n, %]	As education level increases, mask wearing non-adherence increases [n, %]	Relationship between education and mask wearing adherence is non-linear [n, %]		
Studies	5 [71%]			2 [29%]	7
Studies	4 [57%]	0	1 [14%]	2 [29%]	7
Region					
Europe	0	0	0	0	0
North America	2 [67%]	0	0	1 [33%]	3
Asia	2 [100%]	0	0	0	2
Oceania	0	0	0	0	0
South America	0	0	1 [50%]	1 [50%]	2
Africa	0	0	0	0	0

Cultural Group					
Anglo	2 [67%]	0	0	1 [33%]	3
Germanic Europe	0	0	0	0	0
Nordic Europe	0	0	0	0	0
Eastern Europe	0	0	0	0	0
Latin Europe	0	0	0	0	0
Latin America	0	0	1 [50%]	1 [50%]	2
Southern Asia	0	0	0	0	0
Confucian Asia	1 [100%]	0	0	0	1
Sub-Saharan Africa	0	0	0	0	0
Middle East	1[100%]	0	0	0	1
Income					
High Income	3 [75%]	0	0	1 [25%]	4
Upper Middle Income	1 [33%]	0	1 [33%]	1 [33%]	3
Lower Middle Income	0		0	0	0
Low Income	0	0	0	0	0

Overall: Out of the studies that considered the association between education and mask wearing adherence, 71 per cent [5 out of 7] found education to be predictive, such that it can be concluded with high confidence that education is predictive of mask wearing adherence. Of the five studies that found education to be predictive of mask wearing adherence, 80 per cent [4 out of 5] found that, as education level increases, mask wearing non-adherence decreases, such that it can be concluded with high confidence that, when education is predictive of mask wearing non-adherence, the association is negative. However, out of all studies, only 57 per cent [4 out of 7] found that, as education level increases, mask wearing non-adherence decreases, such that, overall, it can be concluded with some confidence that, as education level increases, mask wearing non-adherence decreases (i.e., less educated people are more likely to not adhere).

In looking for patterns by region, cultural group and income of the countries in the studies, an association between education and mask wearing adherence is evident when segmenting by income, but there is insufficient evidence to draw any conclusions on the basis of region and cultural group.

Income: Out of the studies conducted in high income countries, 75 per cent [3 out of 4] found that education was not associated with mask wearing adherence so that it can be concluded with some confidence that, in high income countries, education is not associated with mask wearing adherence.

There is insufficient evidence to draw conclusions about the relationship between education and mask wearing adherence in the context of upper middle income countries [2 studies].

There is no evidence to draw conclusions about the relationship between education and mask wearing adherence in the contexts of lower middle income [0 studies] and low income [0 studies] countries.

DEMOGRAPHICS
INCOME

5.1.4

Income is the regular money received by an individual through work, a pension, investments, benefits or other sources. Income was primarily measured as a categorical, but ordered, variable using different money ranges, differing in terms of unit of income (e.g., household income or individual income) and time frame of income (e.g., monthly or annual income).

In total, four studies considered the association between income and mask wearing adherence. Of these, two found that income was predictive of mask wearing adherence and two found that income was not predictive of mask wearing adherence. Of the two studies that found income was predictive of mask wearing adherence, one found that, as income increases, mask wearing non-adherence decreases (i.e., those with a lower income are more likely to not adhere) and one found that the relationship between income and mask wearing adherence was non-linear.

As income increases, mask wearing non-adherence decreases

Table 16: Studies evidencing that, as income increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Pereira-Ávila et al. (2021)	Brazil	South America	Latin America	Upper Middle Income

Brazil, Pereira-Ávila et al. (2021): The objective of the study by Pereira-Ávila et al. (2021) was to evaluate the practice of using face masks by the population of Paraíba, Brazil, during the COVID-19 pandemic. Using a cross-sectional descriptive-analytical design, Pereira-Ávila et al. (2021) assessed the outcome variable of face mask usage in 1,327 adult participants living in Paraíba against the independent variables of sex, age group, education, family income, marital status, hand washing and social isolation using analysis of variance or the Student's t-test (social isolation and sex). Family income was a significant factor [$p < 0.01$] in mask wearing; in general, those with higher family income were more likely to wear a face mask, such that income is positively associated with mask wearing.

Relationship between income and mask wearing adherence is non-linear

Table 17: Studies evidencing that, the relationship between income and mask wearing adherence is non-linear

	Study	Country	Region	Cultural Group	Income
1	Anderson and Stockman (2020)	United States	North America	Anglo	High Income

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting the practice of wearing a face mask in public. Using stepwise backwards elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model; women with an annual household income of less than US$30,000 were over twice as likely to wear a mask [OR: 2.284, p = 0.016], as were women in households making more than US$50,000 annually [OR: 2.25, p = 0.013], compared with those making between US$30,000 and US$50,000. As such, this study found that the relationship between income and mask wearing is non-linear.

Income is not associated with mask wearing adherence

Table 18: Studies evidencing that income is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Milad and Bogg (2021)	United States	North America	Anglo	High Income
2	Fisher et al. (2020)	United States	North America	Anglo	High Income

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Income was not a significant factor in adherence to mask wearing.

United States, Fisher et al. (2020): Fisher et al. (2020) surveyed a representative sample of adults (n = 1,005) in the United States in the month following the government recommendation to wear face coverings. The outcome of interest was the use of face coverings within the previous six weeks. No trend was seen in income, with 84.8 per cent of those earning more than US$100,000 per annum the most likely to wear a mask and those earning between US$50,000 and US$99,999 the least likely [72.2 per cent]. Those who own their own home were slightly more likely to wear a mask [79.2 per cent] than those who rented [78.1 per cent] or lived with others at no cost [56.6 per cent]. No statistical data were reported.

Conclusions

Table 19: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]			Non-predictive [n, %]	Total
	As income increases, mask wearing non-adherence decreases [n, %]	As income increases, mask wearing non-adherence increases [n, %]	Relationship between income and mask wearing adherence is non-linear [n, %]		
Studies	2 [50%]			2 [50%]	4
Studies	1 [25%]	0	1 [25%]	2 [50%]	4
Region					
Europe	0	0	0	0	0
North America	0	0	1 [33%]	2 [67%]	3
Asia	0	0	0	0	0
Oceania	0	0	0	0	0
South America	1 [100%]	0	0	0	1
Africa	0	0	0	0	0
Cultural Group					
Anglo	0	0	1 [33%]	2 [67%]	3
Germanic Europe	0	0	0	0	0
Nordic Europe	0	0	0	0	0
Eastern Europe	0	0	0	0	0
Latin Europe	0	0	0	0	0
Latin America	1 [100%]	0	0	0	1
Southern Asia	0	0	0	0	0
Confucian Asia	0	0	0	0	0
Sub-Saharan Africa	0	0	0	0	0
Middle East	0	0	0	0	0

Income					
High Income	0	0	1 [33%]	2 [67%]	3
Upper Middle income	1 [100%]	0	0	0	1
Lower Middle income	0	0	0	0	0
Low Income	0	0	0	0	0

Overall: Of the studies that considered the association between income and mask wearing adherence, 50 per cent [2 out of 4] found income to be predictive and 50 per cent [2 out of 4] found income to be non-predictive, such that it is inconclusive as to whether income is predictive of mask wearing adherence, although, when breaking down studies further into the different categories of predictive findings, 50 per cent [2 out of 4] of studies found income is not associated with mask wearing adherence, so that it can be concluded with some confidence that income is not associated with mask wearing adherence.

In looking for patterns by region, cultural group and income of the countries in the studies, no associations between income and mask wearing adherence are evident due to insufficient evidence.

DEMOGRAPHICS
RACE/ETHNICITY

5.1.5

Race is the physical traits an individual is born with and ethnicity is the cultural identification that an individual learns. Only races/ethnicities that were featured in multiple studies were considered, resulting in evidence purely from the Anglo cultural group. Race/ethnicity was most frequently measured as a categorical variable, but also as a binary variable (e.g., White vs. non-White).

In total, five studies considered the association between race/ethnicity and mask wearing adherence. Of these, four found that race/ethnicity was predictive of mask wearing adherence and one found that race/ethnicity was not predictive of mask wearing. Of the five studies that found race/ethnicity was predictive of mask wearing adherence, three found that members of Black ethnic groups were most likely to wear a mask and one found that White people were most likely to wear a mask.

Members of Black ethnic groups are most likely to adhere to mask wearing measures

Table 20: Studies evidencing that members of Black ethnic groups are most likely to adhere to mask wearing measures

	Study	Country	Region	Cultural Group	Income
1	Hearne and Niño (2021)	United States	North America	Anglo	High Income
2	Stosic et al. (2021)	United States	North America	Anglo	High Income
3	Fisher et al. (2020)	United States	North America	Anglo	High Income

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimates (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported that Black [OR: 2.24, $p < 0.001$], Latino [OR: 1.62, $p < 0.05$] and Asian people [OR: 2.87, $p < 0.001$] were more likely to wear a mask than White people (reference group).

United States, Stosic et al. (2021): Stosic et al. (2021) investigated whether a belief in science directly impacts reported face mask wearing in the United States and the mediating role of belief in mask effectiveness. Using a cross-sectional survey design of 1,050 adult participants, analysed using ordinal logistic regression controlling for age, gender, race, region and political ideology, Stosic et al. (2021) report that ethnicity is a significant predictor of mask wearing, with people with an Hispanic or Latino ethnicity less likely to wear a mask than those not of Hispanic or Latino ethnicity [direct effect – OR: 0.51, $p < 0.01$]. Black people were significantly more likely to wear a mask than White people [direct effect – OR: 2.03, $p < 0.01$] with no difference between White people and Asian people or those of an 'other' ethnicity.

United States, Fisher et al. (2020): Fisher et al. (2020) surveyed a representative sample of adults (n = 1,005) in the United States in the month following the government recommendation to wear face coverings.

The outcome of interest was use of face coverings within the previous six weeks. Non-Hispanic Black people were most likely to wear a mask [82.3 per cent], then those of Hispanic or Latino ethnicity [76.2 per cent], then non-Hispanic White people [75.1 per cent]. Statistical analysis was not reported.

Members of White ethnic groups are most likely to adhere to mask wearing measures

Table 21: Studies evidencing that members of White ethnic groups are most likely to adhere to mask wearing measures

	Study	Country	Region	Cultural Group	Income
1	Cunningham and Nite (2021)	United States	North America	Anglo	High Income

United States, Cunningham and Nite (2021): Using data collected from secondary sources, Cunningham and Nite (2021) assessed the predictability of mask wearing in the United States from health behaviours, clinical care, environmental factors and socio-economic conditions, using regression modelling, hypothesizing that, as these factors increase, so too would the use of face masks. Data concerning mask wear were taken from a survey of 250,000 people with responses aggregated at the county level weighted by age, gender and zip code. Health data were taken from the County Health Rankings & Roadmaps website. Cunningham and Nite (2021) controlled for gender, age (over and under 65), setting (urban, rural) and voting preference. Ethnicity was associated with mask wearing, with White people slightly more likely to wear a mask [$p < 0.05$].

Race/ethnicity not associated with mask wearing adherence

Table 22: Studies evidencing that race/ethnicity is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Anderson and Stockman (2020)	United States	North America	Anglo	High Income

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting the practice of wearing a face mask in public. Using stepwise backwards elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model; no variance was reported in the likelihood of wearing a face mask by ethnicity.

Conclusions

Table 23: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	Members of Black ethnic groups are most likely to wear a mask [n, %]	Members of White ethnic groups are most likely to wear a mask [n, %]		
Studies	4 [80%]		1 [20%]	5
Studies	3 [60%]	1 [20%]	1 [20%]	5
Region				
Europe	0	0	0	0
North America	3 [60%]	1 [20%]	1 [20%]	5
Asia	0	0	0	0
Oceania	0	0	0	0
South America	0	0	0	0
Africa	0	0	0	0
Cultural Group				
Anglo	3 [60%]	1 [20%]	1 [20%]	5
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	0	0
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0

Middle East	0	0	0	0
Income				
High Income	3 [60%]	1 [20%]	1 [20%]	5
Upper Middle Income	0	0	0	0
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the association between race/ethnicity and mask wearing adherence, 80 per cent [4 out of 5] found that race/ethnicity is predictive of mask wearing adherence, so that it can be concluded with high confidence that race/ethnicity is associated with mask wearing adherence. Of the four studies that found race/ethnicity to be predictive of mask wearing adherence, 75 per cent [3 out of 4] found that members of Black ethnic groups were most likely to wear a mask, so that it can be concluded with high confidence that, when race/ethnicity is predictive of mask wearing adherence, members of Black ethnic groups are most likely to wear a mask. Of all studies, 60 per cent [3 out of 5] found that members of Black ethnic groups were most likely to wear a mask, so that, overall, it can be confidently concluded that members of Black ethnic groups are most likely to wear a mask.

In looking for patterns by region, cultural group and income of the countries in the studies, some associations between sex/gender and mask wearing adherence are evident.

Region: Of the studies conducted in North American countries, 60 per cent [3 out of 5] found that members of Black ethnic groups were most likely to wear a mask, so that it can be confidently concluded that, in North American countries, members of Black ethnic groups are most likely to wear a mask.

There is no evidence to draw conclusions about the relationship between race/ethnicity and mask wearing adherence in the contexts of European [0 studies], Asian [0 studies], Oceanian [0 studies], South American [0 studies] and African [0 studies] countries.

Cultural group: Of the studies conducted in Anglo cultural group countries, 60 per cent [3 out of 5] found that members of Black ethnic groups were most likely to wear a mask, so that it can be confidently concluded that, in Anglo cultural group countries, members of Black ethnic groups are most likely to wear a mask.

There is no evidence to draw conclusions about the relationship between race/ethnicity and mask wearing adherence in the contexts of Germanic European [0 studies], Nordic European [0 studies], Eastern European [0 studies], Latin European [0 studies], Latin American [0 studies], Southern Asian [0 studies], Confucian Asian [0 studies], Sub-Saharan African [0 studies] and Middle Eastern [0 studies] cultural group countries.

Income: Of the studies conducted in high income countries, 60 per cent [3 out of 5] found that members of Black ethnic groups were most likely to wear a mask, so that it can be confidently concluded that, in high income countries, members of Black ethnic groups are most likely to wear a mask.

There is no evidence to draw conclusions about the relationship between race/ethnicity and mask wearing adherence in the contexts of upper middle income [0 studies], lower middle income [0 studies] and low income [0 studies] countries.

DEMOGRAPHICS
MARITAL STATUS

5.1.6

Marital status is the legally defined status with regards to a person's relationship with a significant other. In the evidence reviewed, marital status was most frequently measured as a binary variable (i.e., married vs. unmarried), but also as a categorical variable with additional categories (e.g., divorced, widowed).

In total, three studies considered the association between marital status and mask wearing adherence. Of these, one found that marital status was predictive of mask wearing adherence and two found that marital status was not predictive of mask wearing adherence. The study that found marital status was predictive of mask wearing found that unmarried people are more likely to not adhere to mask wearing measures.

Unmarried people are more likely to not adhere to mask wearing measures

Table 24: Studies evidencing that unmarried people are more likely to not adhere to mask wearing measures

	Study	Country	Region	Cultural Group	Income
1	Pereira-Ávila et al. (2021)	Brazil	South America	Latin America	Upper Middle Income

Brazil, Pereira-Ávila et al. (2021): The objective of the study by Pereira-Ávila et al. (2021) was to evaluate the practice of using face masks by the population of Paraíba, Brazil, during the COVID-19 pandemic. Using a cross-sectional descriptive-analytical design, Pereira-Ávila et al. (2021) assessed the outcome variable of face mask usage in 1,327 adult participants living in Paraíba against the independent variables of sex, age group, education, family income, marital status, hand washing and social isolation using analysis of variance or the Student's t-test (social isolation and sex). A significant difference was reported in the variance in mask wearing by marital status grouping: those separated were the most likely to wear a face mask, followed by those who were married, then widowers and finally those who were single. There was some variation by setting; the significant results held true in healthcare settings and in public, but no differences were reported in score on the scale of face mask use at home (scores were lower across the board for use at home).

Marital status is not associated with mask wearing adherence

Table 25: Studies evidencing that marital status is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Anderson and Stockman (2020)	United States	North America	Anglo	High Income
2	Hearne and Niño (2021)	United States	North America	Anglo	High Income

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting the practice of wearing a face mask in public. Using stepwise backwards elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model; being in a relationship was suggested to increase the likelihood of mask wearing, however, this was not included in the final model. Living with others did also not predict mask wearing.

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimates (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported no differences in mask wearing by marital status.

Conclusions

Table 26: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	Unmarried people are more likely to not adhere to mask wearing [n, %]	Married people are more likely to not adhere to mask wearing [n, %]		
Studies	1 [33%]		2 [67%]	3
Studies	1 [33%]	0	2 [67%]	3
Region				
Europe	0	0	0	0
North America	0	0	2 [100%]	2
Asia	0	0	0	0
Oceania	0	0	0	0
South America	1 [100%]	0	0	1

Africa	0	0	0	0
Cultural Group				
Anglo	0	0	2 [100%]	2
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	1 [100%]	0	0	1
Latin America	0	0	0	0
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	0	0	2 [100%]	2
Upper Middle Income	1 [100%]	0	0	1
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: There is insufficient evidence to draw conclusions about the relationship between marital status and mask wearing adherence, including when looking for patterns by region, cultural group and income of the countries in the studies.

DEMOGRAPHICS
LIVING AREA

5.1.7

Living area was defined in terms of urban-rural classification. An urban living area is a densely developed area of cities or towns, whereas a rural living area is one not densely developed outside of cities and towns in the countryside. Living area was measured as a binary variable (i.e., urban vs. rural).

In total, four studies considered the association between living area and mask wearing adherence. Of these, two found that living area was predictive of mask wearing adherence and two found that living area was not predictive of mask wearing adherence. Of the two studies that found living area was predictive of mask wearing, one found that rural dwellers are more likely to not adhere to mask wearing and one found that urban dwellers are more likely to not adhere to mask wearing.

Rural dwellers are more likely to not adhere to mask wearing measures

Table 27: Studies evidencing that rural dwellers are more likely to not adhere to mask wearing measures

	Study	Country	Region	Cultural Group	Income
1	Stosic et al. (2021)	United States	North America	Anglo	High Income

United States, Stosic et al. (2021): Stosic et al. (2021) investigated whether a belief in science directly impacts reported face mask wearing in the United States and the mediating role of belief in mask effectiveness. Using a cross-sectional survey design of 1,050 adult participants, analysed using ordinal logistic regression controlling for age, gender, race, ethnicity, region and political ideology, Stosic et al. (2021) report that urban dwellers are more likely to wear a mask compared with suburban or rural-dwellers [total effect – OR: 1.67, $p < 0.001$; direct effect – OR: 1.80, $p < 0.001$].

Urban dwellers are more likely to not adhere to mask wearing measures

Table 28: Studies evidencing that urban dwellers are more likely to not adhere to mask wearing measures

	Study	Country	Region	Cultural Group	Income
1	Anderson and Stockman (2020)	United States	North America	Anglo	High Income

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting the practice of wearing a face mask in public. Using stepwise backwards elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model; education, knowing where to get tested, household income and environment (urban/rural) were all included in the final model. Living in an urban community decreased the odds of mask wearing by about 60 per cent [OR: 0.41, p = 0.002].

Living area is not associated with mask wearing adherence

Table 29: Studies evidencing that living area is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Barile et al. (2020)	United States	North America	Anglo	High Income
2	Cunningham and Nite (2021)	United States	North America	Anglo	High Income

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States (n = 885), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education), adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intentions to use, and use of, a face covering. No differences were reported by rural or urban setting and the use, or intended use, of face coverings.

United States, Cunningham and Nite (2021): Data concerning mask wear were taken from a survey of 250,000 people with responses aggregated at the county level weighting by age, gender and zip code. Health data were taken from the County Health Rankings & Roadmaps website. Cunningham and Nite (2021) controlled for gender, age (over and under 65), ethnicity (White and non-White) and voting preference. Setting (rural or urban) was not significantly associated with mask wearing.

Conclusions

Table 30: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	Rural dwellers are more likely to not adhere to mask wearing [n, %]	Urban dwellers are more likely to adhere to mask wearing [n, %]		
Studies	2 [50%]		2 [50%]	4
Studies	1 [25%]	1 [25%]	2 [50%]	4
Region				
Europe	0	0	0	0
North America	1 [25%]	1 [25%]	2 [50%]	4
Asia	0	0	0	0
Oceania	0	0	0	0

South America	0	0	0	0
Africa	0	0	0	0
Cultural Group				
Anglo	1 [25%]	1 [25%]	2 [50%]	4
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	0	0
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	1 [25%]	1 [25%]	2 [50%]	4
Upper Middle Income	0	0	0	0
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the association between living area and mask wearing adherence, 50 per cent [2 out of 4] found living area to be predictive and 50 per cent [2 out of 4] found living area to be non-predictive, such that it is inconclusive as to whether living area is predictive of mask wearing adherence, although, when breaking down studies further into the different categories of predictive findings, 50 per cent [2 out of 4] of studies found living area is not associated with mask wearing adherence, so that it can be concluded with some confidence that living area is not associated with mask wearing adherence.

In looking for patterns by region, cultural group and income of the countries in the studies, some associations between sex/gender and mask wearing adherence are evident.

Region: Of the studies conducted in North American countries, 50 per cent [2 out of 4] of studies found that living area is not associated with mask wearing adherence, so that it can be concluded with some confidence that, in North American countries, living area is not associated with mask wearing adherence.

There is no evidence to draw conclusions about the relationship between living area and mask wearing adherence in the contexts of European [0 studies], Asian [0 studies], Oceanian [0 studies], South American [0 studies] and African [0 studies] countries.

Cultural group: Of the studies conducted in North Anglo cultural group countries, 50 per cent [2 out of 4] found that living area is not associated with mask wearing adherence, so that it can be concluded with some confidence that, in Anglo cultural groups countries, living area is not associated with mask wearing adherence.

There is no evidence to draw conclusions about the relationship between living area and mask wearing adherence in the contexts of Germanic European [0 studies], Nordic European [0 studies], Eastern European [0 studies], Latin European [0 studies], Latin American [0 studies], Southern Asian [0 studies], Confucian Asian

[0 studies], Sub-Saharan African [0 studies] and Middle Eastern [0 studies] cultural group countries.

Income: Of the studies conducted in high income countries, 50 per cent [2 out of 4] found that living area is not associated with mask wearing adherence, so that it can be concluded with some confidence that, in high income countries, living area is not associated with mask wearing adherence.

There is no evidence to draw conclusions about the relationship between living area and mask wearing adherence in the contexts of upper middle income [0 studies], lower middle income [0 studies] and low income [0 studies] countries.

DEMOGRAPHICS
HEALTH STATUS

5.1.8

Health status is an individual's relative level of wellness and illness. Health status was measured as a categorical variable.

In total, three studies considered the association between health status and mask wearing adherence. All three found that health status was not predictive of mask wearing adherence.

Health status is not associated with mask wearing adherence

Table 31: Studies evidencing that health status is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Anderson and Stockman (2020)	United States	North America	Anglo	High Income
2	Hearne and Niño (2021)	United States	Oceania	Anglo	High Income
3	Milad and Bogg (2021)	United States	North America	Anglo	High Income

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting women's practice of wearing a face mask in public. Using stepwise backward elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model. No variance was reported in the likelihood of wearing a face mask by current health status, having a long-term condition, having had COVID-19 symptoms, or having been tested or diagnosed with COVID-19.

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimates (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported no differences in mask wearing by health status.

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Self-related health was not correlated with adherence to mask wearing; a pathway model also did not find this to be a significant factor.

Conclusions

Table 32: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	As health status improves, mask wearing non-adherence increases [n, %]	As health status improves, mask wearing non-adherence decreases [n, %]		
Studies	0	0	3 [100%]	3
Studies	0	0	3 [100%]	3
Region				
Europe	0	0	0	0
North America	0	0	3 [100%]	3
Asia	0	0	0	0
Oceania	0	0	0	0
South America	0	0	0	0
Africa	0	0	0	0
Cultural Group				
Anglo	0	0	3 [100%]	3
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	0	0
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0

Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	0	0	3 [100%]	3
Upper Middle Income	0	0	0	0
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: There is insufficient evidence to draw conclusions about the relationship between health status and mask wearing adherence, including when looking for patterns by region, cultural group and income of the countries in the studies.

DEMOGRAPHICS
ACCESS TO HEALTH CARE

5.1.9

Access to health care is whether or not an individual has access to health care, including health insurance. Health status was measured as a binary variable (i.e., yes vs. no).

In total, two studies considered the association between health status and mask wearing adherence. Both found that health status was not predictive of mask wearing adherence.

Access to health care is not associated with mask wearing adherence

Table 33: Studies evidencing that access to health care is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Cunningham and Nite (2021)	United States	North America	Anglo	High Income
2	Hearne and Niño (2021)	United States	North America	Anglo	High Income

United States, Cunningham and Nite (2021): Data concerning mask wear were taken from a survey of 250,000 people with responses aggregated at the county level weighting by age, gender and zip code. Health data were taken from the County Health Rankings & Roadmaps website. Cunningham and Nite (2021) controlled for gender, age (over and under 65), ethnicity (White and non-White), setting (urban, rural) and voting preference. Cunningham and Nite (2021) reported that clinical care did not hold a significant association with mask wearing.

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimates (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported no differences by health insurance status.

Conclusions

Table 34: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	Access to health care increases likelihood of mask wearing non-adherence [n, %]	Access to health care decreases likelihood of mask wearing non-adherence [n, %]		
Studies	0		2 [100%]	2
Studies	0	0	2 [100%]	2
Region				
Europe	0	0	0	0
North America	0	0	2 [100%]	2
Asia	0	0	0	0
Oceania	0	0	0	0
South America	0	0	0	0
Africa	0	0	0	0
Cultural Group				
Anglo	0	0	2 [100%]	2
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	0	0
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0

Income				
High Income	0	0	2 [100%]	2
Upper Middle Income	0	0	0	0
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: There is insufficient evidence to draw conclusions about the relationship between access to health care and mask wearing adherence, including when looking for patterns by region, cultural group and income of the countries in the studies.

WHY ARE PEOPLE MORE LIKELY TO NOT ADHERE TO MASK WEARING MEASURES AND IN WHAT CONTEXT?

06

SOCIAL OPPORTUNITY
PERCEIVED SOCIAL NORMATIVE PRESSURE

6.1.1

Social normative pressure is an individual's perception of pressure in the form of the judgement of significant others with regard to whether a particular behaviour should be performed or not. Perceived social normative pressure was measured as an ordinal variable (i.e., on a scale).

In total, seven studies considered the relationship between perceived social normative pressure and mask wearing adherence. Of these, six found that perceived social normative pressure was predictive of mask wearing adherence and one found that perceived social normative pressure was not predictive of mask wearing adherence. Of the six studies that found perceived social normative pressure was predictive of mask wearing adherence, all found that, as perceived social normative pressure increases, mask wearing non-adherence decreases (i.e., those who perceive less social normative pressure to wear a mask are more likely to not adhere).

As perceived social normative pressure increases, mask wearing non-adherence decreases

Table 35: Studies evidencing that, as perceived social normative pressure increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Freidin et al. (2021)	Argentina	Europe	Latin America	Upper Middle Income
2	Sun et al. (2021)	China	Asia	Confucian Asia	High Income
3	Barile et al. (2020)	United States	North America	Anglo	High Income
4	Cunningham and Nite (2021)	United States	North America	Anglo	High Income
5	Hearne and Niño (2021)	United States	North America	Anglo	High Income
6	Datta et al. (2021)	United States	North America	Anglo	High Income

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed a survey of 578 adult respondents in Argentina to assess the predictors of mask wearing using hierarchically organized regressions. The entering order of factors in the regression analysis was as follows: age, gender, education, contagion risk, illness severity, benefits (mask effectiveness), costs and norms. The model with the greatest predictive validity of variance included all of the aforementioned regression factors, explaining 39 per cent of the variance [$p < 0.001$]. Freidin et al. (2021) reported that social norms were a significant predictor of mask wearing, explaining 26 per cent of the variance [$p < 0.001$].

China, Sun et al. (2021): Sun et al. (2021) predicted that attitude, subjective norms and perceived behavioural control were all positively associated with the intention to wear a face mask. Further, Sun et al. (2021) predicted that subjective norms are affected by attitude and perceived behavioural control towards mask wearing. Sun et al. (2021) used a cross-sectional survey design with a convenience sample of 477 international university students studying in China to investigate these hypotheses, assessed using structural equation modelling. Attitude and perceived behavioural control were, respectively, directly and positively related to behavioural intention (attitude explained 14.8 per cent of the variance; perceived behaviour control explained 13.1 per cent of the variance). Subjective norm had a direct effect on attitude (explaining 21 per cent of the variance), perceived behavioural control (explaining 34 per cent of the variance) and behavioural intention (explaining 58.8 per cent of the variance). Subjective norm also indirectly promoted behavioural intention through attitude and perceived behavioural control (7.5 per cent of the variance). The effects of living area, countries where international students were living, and grade were controlled.

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States ($n = 885$), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education), adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intentions to use, and use of, a face covering. Intention to wear a face covering was positively associated with wearing a cloth face mask when other people were observed doing the same in public at least "rarely" [OR = 1.43], with a stronger association if they observed others as "sometimes" [OR = 1.83], "often" [OR = 2.32], or "always" [OR = 2.96] wearing a face mask. For other types of face masks, a positive association between intention and behaviour is only present when observing others wearing face masks "often" [OR = 1.25] or "always" [OR = 1.48].

United States, Cunningham and Nite (2021): Using data collected from secondary sources, Cunningham and Nite (2021) assessed the predictability of mask wearing in the United States from health behaviours, clinical care, environmental factors and socio-economic conditions, hypothesizing that, as these factors increase, so too would the use of face masks, assessed using regression modelling. Data concerning mask wear were taken from a survey of 250,000 people with responses aggregated at the county level weighting by age, gender and zip code. Health data were taken from the County Health Rankings & Roadmaps website. Cunningham and Nite (2021) controlled for gender, age (over and under 65), ethnicity (White and non-White), setting (urban, rural) and voting preference. Cunning and Nite (2021) found that people were more likely to wear masks when residing in counties where healthy behaviours were commonplace [estimate = 0.120, standard error = 0.021, $p < 0.001$].

United States, Hearne and Niño (2021): Hearne and Niño (2021) took a representative sample of 4,688 adults from the United States COVID Impact Survey. The primary outcome variable was mask wearing adherence. Logistic regression estimate (including ethnicity, gender, time of survey completion, age, household income, level of education, marital status, region, work status, health insurance and self-reported physical health) reported that adherence increased across the time points of the survey [April 2020: reference category; May 2020, OR: 1.23, not significant; June, OR: 1.79, $p < 0.001$] suggesting that people were more willing to wear a mask as the size, scale and severity of the pandemic increased and mask wearing became commonplace.

United States, Datta et al. (2021): Datta et al. (2021) conducted semi-structured interviews with 16 healthcare professionals on the barriers and facilitators to face mask compliance. The qualitative study identified a need for communication from management with positive reinforcement, presenting that others are wearing masks and that they feel it important to do so.

Social normative pressure is not associated with mask wearing adherence

Table 36: Studies evidencing that social normative pressure is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Milad and Bogg (2021)	United States	North America	Anglo	High Income

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Perceived social norms were significantly correlated to mask wearing [$r^2 = 0.22$, $p < 0.01$), however, a pathway analysis did not find this to be a significant factor.

Conclusions

Table 37: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	As perceived social normative pressure increases, mask wearing non-adherence decreases [n, %]	As perceived social normative pressure increases, mask wearing non-adherence increases [n, %]		
Studies	6 [86%]		1 [14%]	7
Studies	6 [86%]	0	1 [14%]	7
Region				
Europe	0	0	0	0
North America	4 [80%]	0	1 [20%]	5
Asia	1 [100%]	0	0	1
Oceania	0	0	0	0
South America	1 [100%]	0	0	1
Africa	0	0	0	0
Cultural Group				
Anglo	4 [80%]	0	1 [20%]	5
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0

Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	1 [100%]	0	0	1
Southern Asia	0	0	0	0
Confucian Asia	1 [100%]	0	0	1
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	5 [83%]	0	1 [17%]	6
Upper Middle Income	1 [100%]	0	0	1
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the association between perceived social normative pressure and mask wearing adherence, 86 per cent [6 out of 7] found that perceived social normative pressure is predictive of mask wearing adherence, so that it can be concluded with high confidence that perceived social normative pressure is associated with mask wearing adherence. Of the six studies that found perceived social normative pressure to be predictive of mask wearing adherence, 100 per cent [6 out of 6] found that, as perceived social normative pressure increases, mask wearing non-adherence decreases (i.e., those who perceive less social normative pressure to wear a mask are more likely to not adhere), so that it can be concluded with high confidence that, when perceived social normative pressure is predictive of mask wearing non-adherence, the association is negative. Out of all studies, 86 per cent [6 out of 7] found that, as perceived social normative pressure increases, mask wearing non-adherence decreases, so that, overall, it can be concluded with high confidence that, as perceived social normative pressure increases, mask wearing non-adherence decreases (i.e., those who perceive less social normative pressure to wear a mask are more likely to not adhere).

In looking for patterns by region, cultural group and income of the countries in the studies, some associations between sex/gender and mask wearing adherence are evident.

Region: Of the studies conducted in North American countries, 80 per cent [4 out of 5] found that, as perceived social normative pressure increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in North American countries, as perceived social normative pressure increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived social normative pressure and mask wearing adherence in the contexts of Asian [1 study] and South American [1 study] countries.

There is no evidence to draw conclusions about the relationship between perceived social normative pressure and mask wearing adherence in the contexts of European [0 studies], Oceanian [0 studies] and African [0 studies] countries.

Cultural group: Of the studies conducted in Anglo cultural group countries, 80 per cent [4 out of 5] found that, as perceived social normative pressure increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in Anglo cultural group countries, as perceived social normative pressure increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived social normative pressure and mask wearing adherence in the contexts of Latin American [1 study] and Confucian Asian [1 study] cultural group countries.

There is no evidence to draw conclusions about the relationship between perceived social normative pressure and mask wearing adherence in the contexts of Germanic European [0 studies], Nordic European [0 studies], Eastern

European [0 studies], Latin European [0 studies], Southern Asian [0 studies], Sub-Saharan African [0 studies] and Middle Eastern [0 studies] cultural group countries.

Income: Of the studies conducted in high income countries, 83 per cent [5 out of 6] found that, as perceived social normative pressure increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in high income countries, as perceived social normative pressure increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived social normative pressure and mask wearing adherence in the context of upper middle income [1 study] countries.

There is no evidence to draw conclusions about the relationship between perceived social normative pressure and mask wearing adherence in the contexts of lower middle income [0 studies] and low income [0 studies] countries.

SOCIAL OPPORTUNITY
POLITICAL IDEOLOGY

6.1.2

Political ideology refers to peoples political beliefs and affiliations. It was measured either as a categorical variable in terms of political parties voted for or identified with, or on scales associated with political spectrums (e.g., liberal to conservative; left to right) or even as a binary variable (e.g., left vs. right political orientation).

In total, five studies considered the association between political ideology and mask wearing adherence. Of these, all five found that political ideology was predictive of mask wearing adherence. Of the five studies that found political ideology was predictive of mask wearing adherence, all found that right-wing or conservative voters were more likely to not adhere to mask wearing.

Right-wing or conservative voters are more likely to not adhere to mask wearing measures

Table 38: Studies evidencing that right-wing or conservative voters are more likely to not adhere to mask wearing measures

	Study	Country	Region	Cultural Group	Income
1	van der Linden and Savoie (2020)	Canada	North America	Anglo	High Income
2	Cunningham and Nite (2021)	United States	North America	Anglo	High Income
3	Mahalik et al. (2021)	United States	North America	Anglo	High Income
4	Milad and Bogg (2021)	United States	North America	Anglo	High Income
5	Stosic et al. (2021)	United States	North America	Anglo	High Income

Canada, van der Linden and Savoie (2020): Using a cross-sectional survey design with 2,194 participants stratified by age, sex, education, partisanship and region, van der Linden and Savoie (2020) assessed whether Canadians exhibit a higher propensity to wear masks in response to appeals to a sense of collective interest or self-interest. A linear regression model (including the categorical independent variables of sex, age group, highest level of educational attainment and vote choice in the 2019 Canadian federal election, as well as the impact of self or collective interest on mask wearing) suggested that partisan differences had an effect on the adoption of masks. Those who voted for the Liberal Party [$p < 0.001$] and the New Democratic Party [$p < 0.001$]) in the 2019 Canadian federal election were more likely to wear a face mask than Conservative, Green, and Bloc Québécois voters. The authors suggested that left-leaning Canadians were more receptive to the idea of mask wearing.

United States, Cunningham and Nite (2021): Using data collected from secondary sources, Cunningham and Nite (2021) assess the predictability of mask wearing in the United States from health behaviours, clinical care, environmental factors and socio-economic conditions hypothesizing that, as these factors increase, so too would the use of face masks, assessed using regression modelling. Data concerning mask wearing were taken from a survey of 250,000 people with responses aggregated at the county level weighting by age, gender and zip code. Health data were taken from the County Health Rankings & Roadmaps website. Cunningham and Nite (2021) controlled for gender, age (over and under 65), ethnicity (White and non-White) and setting (urban, rural). Democrat voters were more likely to wear a mask [estimate = 0.051, standard error = 0.003, $p < 0.001$].

United States, Mahalik et al. (2021): Mahalik et al. (2021) investigated the impact of conformity to male masculine norms on attitudes to wearing a face mask. Mahalik et al. (2021) reported findings from an online survey of 596 male adults from the United States that greater conformity to male masculine norms results in a significant reduction in attitude towards use of face coverings [$B = -0.02$, $p < 0.001$]. This relationship was mediated by perceived benefits of mask wearing; those with high conformity were less likely to perceive benefits compared with those with low conformity to masculine norms, more likely to perceive barriers, and less likely to have confidence in science and empathy for vulnerable people. These mediating factors were in turn influenced by political ideology, with liberals seeing greater benefits, perceiving fewer barriers, and having greater confidence in the scientific community and more empathy.

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Political views (conservative) were negatively correlated to adherence to mask wearing [$r^2 = -0.20$, $p < 0.01$] and were found to be a significant predictor in the pathway analysis explaining 14 per cent of the variance [negatively in relation to conservative voting; $p < 0.01$].

United States, Stosic et al. (2021): Stosic et al. (2021) investigated whether a belief in science directly impacts reported face mask wearing in the United States and the mediating role of belief in mask effectiveness. Using a cross-sectional survey design of 1,050 adult participants analysed using ordinal logistic regression controlling for age, gender, race, ethnicity and region, Stosic et al. (2021) reported that a liberal political ideology was a predictor of mask wearing [direct effect – OR: 1.16, $p < 0.001$].

Conclusions

Table 39: Analysis of evidence by findings, region, cultural group and income

	Predictive		Non-predictive [n, %]	Total
	Right-wing or conservative voters are more likely to not adhere to mask wearing [n, %]	Left-wing or liberal voters are more likely to adhere to mask wearing [n, %]		
Studies	5 [100%]		0	5
Studies	5 [100%]	0	0	5

Region				
Europe	0	0	0	0
North America	5 [100%]	0	0	5
Asia	0	0	0	0
Oceania	0	0	0	0
South America	0	0	0	0
Africa	0	0	0	0
Cultural Group				
Anglo	5 [100%]	0	0	5
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	0	0
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	5 [100%]	0	0	5
Upper Middle Income	0	0	0	0
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the association between political ideology and mask wearing adherence, 100 per cent [5 out of 5] found that political ideology is predictive of mask wearing adherence, so that it can be concluded with high confidence that political ideology is predictive of mask wearing adherence. Of the five studies that found political ideology to be predictive of mask wearing adherence, 100 per cent [5 out of 5] found that right-wing or conservative voters are more likely to not adhere to mask wearing, so that it can be concluded with high confidence that, when political ideology is predictive of mask wearing adherence, right-wing or conservative voters are more likely to not adhere to mask wearing. Of all the studies, again, 100 per cent [5 out of 5] found that right-wing or conservative voters are more likely to not adhere to mask wearing, so that, overall, it can be concluded with high confidence that right-wing or conservative voters are more likely to not adhere to mask wearing.

In looking for patterns by region, cultural group and income of the countries in the studies, some associations between political ideology and mask wearing adherence are evident.

Region: Of the studies conducted in North American countries, 100 per cent [5 out of 5] found that right-wing or conservative voters are more likely to not adhere to mask wearing, so that it can be concluded with high confidence that, in North American countries, right-wing or conservative voters are more likely to not adhere to mask wearing.

There is no evidence to draw conclusions about the relationship between political ideology and mask wearing adherence in the contexts of European [0 studies], Asian [0 studies], Oceanian [0 studies], South American [0 studies] and African [0 studies] countries.

Cultural group: Of the studies conducted in Anglo cultural group countries, 100 per cent [5 out of 5] found that right-wing or conservative voters are more likely to not adhere to mask wearing, so that it can be concluded with high confidence that, in Anglo cultural group countries, right-wing or conservative voters are more likely to not adhere to mask wearing.

There is no evidence to draw conclusions about the relationship between political ideology and mask wearing adherence in the contexts of Germanic European [0 studies], Nordic European [0 studies], Eastern European [0 studies], Latin European [0 studies], Latin American [0 studies], Southern Asian [0 studies], Confucian Asian [0 studies], Sub-Saharan African [0 studies] and Middle Eastern [0 studies] cultural group countries.

Income: Of the studies conducted in high income countries, 100 per cent [5 out of 5] found that right-wing or conservative voters are more likely to not adhere to mask wearing, so that it can be concluded with high confidence that, in high income countries, right-wing or conservative voters are more likely to not adhere to mask wearing.

There is no evidence from which to draw conclusions about the relationship between political ideology and mask wearing adherence in the contexts of upper middle income [0 studies], lower middle income [0 studies] and low income [0 studies] countries.

SOCIAL OPPORTUNITY
SETTING

6.1.3

Setting refers to the location of the behaviour of mask wearing. It was measured as a categorical variable (e.g., at home, in public).

In total, three studies considered the association between setting and mask wearing adherence. Of these, all three found that setting was predictive of mask wearing adherence (i.e., that mask wearing adherence differed by location).

Setting is associated with mask wearing adherence

Table 40: Studies evidencing that setting is associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income
2	Pereira-Ávila et al. (2021)	Brazil	South America	Latin America	Upper Middle Income
3	Al Naam et al. (2021)	Saudi Arabia	Asia	Middle East	High Income

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed 15,507 observations of adults wearing masks while walking, running and cycling in Argentina for six weeks between May and July 2020, and for a further two weeks between October and November 2020. A probit regression with cycling as the reference category showed that mask wearing was significantly more likely for those walking [$\beta = 0.65$, $p < 0.001$] and marginally less likely for those running [$\beta = -0.07$, $p = 0.08$] relative to those cycling. A negative relationship is reported between group size (larger groups) and mask wearing while walking [$\beta = -0.04$, $p = 0.016$], running [$\beta = -0.17$, $p < 0.001$] and cycling [$\beta = -0.06$, $p = 0.04$]. This mix of results highlights that the behaviour of mask wearing varies across activities and that caution is required if attempting to generalize the determinants of mask wearing across activities. Freidin et al. (2021) also reported that mask wearing significantly decreased over the study period.

Brazil, Pereira-Ávila et al. (2021): The objective of the study by Pereira-Ávila et al. (2021) was to evaluate the practice of using face masks by the population of Paraíba during the COVID-19 pandemic. Using a cross-sectional, descriptive-analytical design, Pereira-Ávila et al. (2021) assessed the outcome variables of face mask usage across a number of domains in 1,327 adult participants living in Paraíba. Descriptive statistics showed that mask wearing differed by environment and context, with 65.5 per cent of participants stating that they would wear a face mask when in a doctor's clinic to protect themselves from illness,

compared with 61.1 per cent in a public place; 55.8 per cent stated that they would wear a face mask in a doctor's clinic if they had signs of illness, compared with 47.5 per cent if in a public place. Only 23.8 per cent stated that they would wear a mask at home if they had signs of illness; 20 per cent of participants stated that they would wear a mask at home if a family member showed signs of illness.

Saudi Arabia, Al Naam et al. (2021): Al Naam et al. (2021) conducted a cross-sectional survey of Saudi residents who were above 16 years old and who had access to the internet; all Saudi residents who met these criteria were invited to participate, with 3,572 responses received. Descriptive statistics reported by Al Naam et al. (2021) showed that 87.2 per cent of respondents agreed to wear a face mask frequently in public places, 80.5 per cent in the workplace, and 47.5 per cent at social gatherings. Al Naam et al. (2021) reported that the most popular place to buy a face mask is a pharmacy (67.1 per cent), followed by a supermarket (7.2 per cent).

Conclusions

Table 41: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]	Non-predictive [n, %]	Total
Studies	3 [100%]	0	3
Region			
Europe	0	0	0
North America	0	0	0
Asia	1 [100%]	0	1
Oceania	0	0	0
South America	2 [100%]	0	2
Africa	0	0	0
Cultural Group			
Anglo	0	0	0
Germanic Europe	0	0	0
Nordic Europe	0	0	0
Eastern Europe	0	0	0
Latin Europe	0	0	0
Latin America	2 [100%]	0	2
Southern Asia	0	0	0
Confucian Asia	0	0	0
Sub-Saharan Africa	0	0	0
Middle East	1 [100%]	0	1

Income			
High Income	1 [100%]	0	1
Upper Middle Income	2 [100%]	0	2
Lower Middle Income	0	0	0
Low Income	0	0	0

Overall: There is insufficient evidence to draw conclusions about the relationship between setting and mask wearing adherence, including when looking for patterns by region, cultural group and income of the countries in the studies.

SOCIAL OPPORTUNITY
MANDATING MASK WEARING

6.1.4

Mandating mask wearing refers to requiring people to wear a face mask in certain situations. It was measured as a binary variable (i.e., presence or absence of a mandate to wear a mask).

In total, three studies considered the association between mandating mask wearing and mask wearing adherence. Of these, all three found that mandating mask wearing was predictive of mask wearing adherence. Of the three studies that found mandating mask wearing was predictive of mask wearing adherence, all found that mandating mask wearing increases likelihood of mask wearing adherence.

Mandating mask wearing increases likelihood of mask wearing adherence

Table 42: Studies evidencing that mandating mask wearing increases likelihood of mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Adjodah et al. (2021)	United States	North America	Anglo	High Income
2	Datta et al. (2021)	United States	North America	Anglo	High Income
3	Milad and Bogg (2021)	United States	North America	Anglo	High Income

United States, Adjodah et al. (2021): Adjodah et al. (2021) conducted secondary analysis of publicly available secondary data sources on adherence to mask wearing by adults in the United States. The data were from online surveys of more than 1 million American residents. Adjodah et al. (2021) weighted the data to be representative of the population of the United States. Adjodah et al. (2021) reported that mask wearing increased by 23.4 per cent in the weeks following mandated action, with a 3.19 per cent decrease in the weeks following the removal of the mandate.

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Those who stated they had followed previous/current guidelines in relation to COVID-19 were significantly more likely to adhere to wearing a face covering [$r^2 = 0.28$, $p < 0.01$;

explaining 13 per cent of the variance in the pathway analysis, $p < 0.01$]. The path analyses also showed a small effect of the presence of a shelter-in-place order being associated with more frequent mask wearing.

United States, Datta et al. (2021): Datta et al. (2021) conducted 1,561 observations of healthcare professionals to assess compliance with use of face mask coverings. This was followed by semi-structured interviews with 16 healthcare professionals on the barriers and facilitators to face mask compliance to influence the development of an intervention to bring about change. Follow-up observations (n = 2,651 observations) occurred over a 14-week period. The qualitative study identified a need for the mandated use of face masks to increase compliance. A mandate for universal face mask coverings was introduced as part of the multimodal intervention, which increased use in the short term [$\beta = 0.02$; $p = 0.002$] but no significant secular trend was observed in face mask compliance over the study period [$\beta = 0.002$; $p = 0.08$]. Datta et al. (2021) did not report what components of the multimodal intervention were impactful.

Conclusions

Table 43: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	Mandating mask wearing increases likelihood of mask wearing adherence [n, %]	Mandating mask wearing decreases likelihood of mask wearing adherence [n, %]		
Studies	3 [100%]		0	3
Studies	3 [100%]	0	0	3
Region				
Europe	0	0	0	0
North America	3 [100%]	0	0	3
Asia	0	0	0	0
Oceania	0	0	0	0
South America	0	0	0	0
Africa	0	0	0	0
Cultural Group				
Anglo	3 [100%]	0	0	3
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	0	0

Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	3 [100%]	0	0	3
Upper Middle Income	0	0	0	0
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: There is insufficient evidence to draw conclusions about the relationship between mandating mask wearing and mask wearing adherence, including when looking for patterns by region, cultural group and income of the countries in the studies.

REFLECTIVE MOTIVATION
PERCEIVED MASK WEARING EFFICACY

6.2.1

Perceived mask wearing efficacy is the belief in the effectiveness of wearing a face mask in terms of preventing catching COVID-19 or spreading it. It is measured as both an ordinal variable (i.e., on a scale) and a categorical variable in terms of level of efficacy.

In total, five studies considered the relationship between perceived mask wearing efficacy and mask wearing adherence. Of these, three found that perceived mask wearing efficacy was predictive of mask wearing adherence and two found that perceived mask wearing efficacy was not predictive of mask wearing adherence. Of the three studies that found that perceived mask wearing efficacy was predictive of mask wearing adherence, all three found that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases (i.e., those who perceive mask wearing to be less effective are more likely to not adhere).

As perceived mask wearing efficacy increases, mask wearing non-adherence decreases

Table 44: Studies evidencing that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Mahalik et al. (2021)	United States	North America	Anglo	High Income
2	Stosic et al. (2021)	United States	North America	Anglo	High Income
3	Fisher et al. (2020)	United States	North America	Anglo	High Income

United States, Mahalik et al. (2021): Mahalik et al. (2021) investigated the impact of conformity to male masculine norms on attitudes to wearing a face mask. Mahalik et al. (2021) report findings from an online survey of 596 male adults from the United States, stating that those perceiving more benefits from mask wearing [$\beta = 0.005$, $p < 0.001$] had a more positive attitude to mark wearing.

United States, Stosic et al. (2021): Stosic et al. (2021) investigated whether a belief in science directly impacted reported face mask wearing in the United States and the mediating role of a belief in mask effectiveness. Using a cross-sectional survey design of 1,050 adult participants, analysed using ordinal logistic regression controlling for age, gender, race, ethnicity, region and political ideology, Stosic et al. (2021) report that a belief in mask effectiveness was a strong predictor of mask wearing [direct effect – OR: 1.82, $p < 0.001$].

United States, Fisher et al. (2020): Fisher et al. (2020) surveyed a representative sample of adults (n = 1,005) in the United States in the month following the government recommendation to wear face coverings. The outcome of interest was the use of face coverings within the previous six weeks. Descriptive statistics showed that 81.8 per cent of those who wore a mark perceived it important to do so; 79.5 per cent of those who wore a mask perceived it important for everyone to do so; 78.1 per cent of those who wore a mask thought it a good idea and a good idea for everyone (77.9 per cent); 76.8 per cent of those who wore a mask in the last six weeks felt that it would protect others and 77.4 per cent believed that it would protect them, with the belief (for 76.3 per cent of them) that it would prevent the spread of COVID-19.

Perceived mask wearing efficacy is not associated with mask wearing adherence

Table 45: Studies evidencing that perceived mask wearing efficacy is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Barile et al. (2020)	United States	North America	Anglo	High Income
2	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States (n = 1,004), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education) and adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intentions to use, and use of, a face covering. Attitude, in terms of perceived importance of wearing a face covering, significantly increased the intention to use a face covering [OR: 4.65, $p < 0.01$], however, this did not result in significant increases in actual use.

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed a survey of 578 respondents to assess the predictors of mask wearing using hierarchically organized regressions. The entering order of factors in the regressions was as follows: age, gender, education, contagion risk, illness severity, benefits (mask effectiveness), costs and norms. The model with the greatest predictive validity of variance reported by Freidin et al. (2021) included all of the aforementioned regression factors, explaining 39 per cent of the variance [$p < 0.001$]. Belief in the effectiveness of mask wearing was not a significant predictor.

Conclusions

Table 46: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	As perceived mask wearing efficacy increases, mask wearing non-adherence decreases [n, %]	As perceived mask wearing efficacy increases, mask wearing non-adherence increases [n, %]		
Studies	3 [60%]		2 [40%]	5
Studies	3 [60%]	0	2 [40%]	5

Region				
Europe	0	0	0	0
North America	3 [75%]	0	1 [25%]	4
Asia	0	0	0	0
Oceania	0	0	0	0
South America	0	0	1 [100%]	1
Africa	0	0	0	0
Cultural Group				
Anglo	3 [75%]	0	1 [25%]	4
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	1 [100%]	1
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	3 [75%]	0	1 [25%]	4
Upper Middle Income	0	0	1 [100%]	1
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the relationship between perceived mask wearing efficacy and mask wearing adherence, 60 per cent [3 out of 5] found perceived mask wearing efficacy to be predictive, so that it can be confidently concluded that perceived mask wearing efficacy is predictive of mask wearing adherence. Of the three studies that found perceived mask wearing efficacy to be predictive of mask wearing adherence, 100 per cent [3 out of 3] found that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases (i.e., those who perceive mask wearing to be less effective are more likely to not adhere). Out of all the studies, 60 per cent [3 out of 5] found that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases (i.e., those with less belief in the efficacy of mask wearing are more likely to not adhere), so that, overall, it can be confidently concluded that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases (i.e., those who perceive mask wearing to be less effective are more likely to not adhere).

In looking for patterns by region, cultural group and income of the countries in the studies, some associations

between perceived mask wearing efficacy and mask wearing adherence are evident.

Region: Of the studies conducted in North American countries, 75 per cent [3 out of 4] found that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in North American countries, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived mask wearing efficacy and mask wearing adherence in the context of South American countries [1 study].

There is no evidence to draw conclusions about the relationship between perceived mask wearing efficacy and mask wearing adherence in the contexts of European [0 studies], Asian [0 studies], Oceanian [0 studies] and African [0 studies] countries.

Cultural group: Of the studies conducted in Anglo cultural group countries, 75 per cent [3 out of 4] found that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in Anglo cultural group countries, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived mask wearing efficacy and mask wearing adherence in the context of Latin American cultural group countries [1 study].

There is no evidence to draw conclusions about the relationship between perceived mask wearing efficacy and mask wearing adherence in the contexts of Germanic European [0 studies], Nordic European [0 studies], Eastern European [0 studies], Latin European [0 studies], Southern Asian [0 studies], Confucian Asian [0 studies], Sub-Saharan African [0 studies] and Middle Eastern [0 studies] cultural group countries.

Income: Of the studies conducted in high income countries, 75 per cent [3 out of 4] found that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in high income countries, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived mask wearing efficacy and mask wearing adherence in the context of upper middle income countries [1 study].

REFLECTIVE MOTIVATION
PERCEIVED VULNERABILITY TO COVID-19

6.2.2

Perceived vulnerability to COVID-19 is the perceived risk of being harmed by COVID-19 if infected, perceived risk of COVID-19, perceived seriousness of contracting COVID-19, fear of COVID-19, and worry of contracting COVID-19. Perceived vulnerability to COVID-19 was measured as an ordinal variable (i.e., on a scale).

In total, four studies considered the association between perceived vulnerability to COVID-19 and mask wearing adherence. Of these, two found that perceived vulnerability was predictive of mask wearing adherence and two found that perceived vulnerability was not predictive of mask wearing adherence. Of the two studies that found perceived vulnerability was predictive of mask wearing adherence, both found that, as perceived vulnerability increases, mask wearing non-adherence decreases (i.e., those who perceive themselves to be less vulnerable to COVID-19 are more likely to not adhere).

As perceived vulnerability to COVID-19 increases, mask wearing non-adherence decreases

Table 47: Studies evidencing that, as perceived vulnerability to COVID-19 increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Barile et al. (2020)	United States	North America	Anglo	High Income
2	Milad and Bogg (2021)	United States	North America	Anglo	High Income

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States (n = 1,004), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education) and adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intentions to use, and use of, a face covering. Perceived severity showed a significant association with the wearing of a paper disposable mask, surgical mask, dust mask, or other respirator, such as an N95 [OR: 1.13, $p < 0.05$].

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing

by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Perceived risk to health of COVID-19 [$r^2 = 0.20$, $p < 0.01$] was positively correlated to mask wearing, but not a significant factor in the pathway analysis.

Perceived vulnerability to COVID-19 is not associated with mask wearing adherence

Table 48: Studies evidencing that perceived vulnerability to COVID-19 is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Anderson and Stockman (2020)	United States	North America	Anglo	High Income
2	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income

United States, Anderson and Stockman (2020): Anderson and Stockman (2020) enrolled 491 adult women from the United States into the COPE Study, a cross-sectional survey of experiences related to COVID-19 and COVID-19 prevention behaviours. Binary logistic modelling was employed to identify factors predicting the practice of wearing a face mask in public. Using stepwise backwards elimination to obtain a parsimonious model with predictive ability, all variables significant at the bivariate level were entered into a regression model. Fear of COVID-19 was not a significant predictor of mask wearing, nor was knowing someone who had had COVID-19 or had been hospitalized because of, or died from, COVID-19.

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed a survey of 578 respondents to assess the predictors of mask wearing using hierarchically organized regressions. The entering order of factors in the regressions was as follows: age, gender, education, contagion risk, illness severity, benefits (mask effectiveness), costs and norms. The model with the greatest predictive validity of variance reported by Freidin et al. (2021) included all of the aforementioned regression factors, explaining 39 per cent of the variance [$p < 0.001$]. Perceived disease severity was not a significant predictor.

Conclusions

Table 49: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	As perceived vulnerability to COVID-19 increases, mask wearing non-adherence decreases [n, %]	As perceived vulnerability to COVID-19 increases, mask wearing non-adherence increases [n, %]		
Studies	2 [50%]		2 [50%]	4
Studies	2 [50%]	0	2 [50%]	4
Region				
Europe	0	0	0	0
North America	2 [67%]	0	1 [33%]	3

Asia	0	0	0	0
Oceania	0	0	0	0
South America	0	0	1 [100%]	1
Africa	0	0	0	0
Cultural Group				
Anglo	2 [67%]	0	1 [33%]	3
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	1 [100%]	1
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	2 [67%]	0	1 [33%]	3
Upper Middle Income	0	0	1 [100%]	1
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the association between perceived vulnerability to COVID-19 and mask wearing adherence, 50 per cent [2 out of 4] found perceived vulnerability to be predictive and 50 per cent [2 out of 4] found perceived vulnerability not to be predictive, such that the relationship between perceived vulnerability to COVID-19 and mask wearing adherence is inconclusive.

There is insufficient evidence to draw conclusions about the relationship between perceived vulnerability to COVID-19 and mask wearing adherence when looking for patterns by region, cultural group and income of the countries in the studies.

REFLECTIVE MOTIVATION
PERCEIVED SUSCEPTIBILITY TO COVID-19

6.2.3

Perceived susceptibility to COVID-19 is the perceived risk of being infected with COVID-19, but does not refer to the perceived risk of being harmed by COVID-19 if infected, which is considered in the previous section as perceived vulnerability. Perceived susceptibility was primarily measured as an ordinal variable (i.e., on a scale).

In total, five studies considered the association between perceived susceptibility to COVID-19 and mask wearing adherence. Of these, four found that perceived susceptibility was predictive of mask wearing adherence and one found that perceived susceptibility was not associated with mask wearing adherence. Of the four studies that found perceived susceptibility was predictive of mask wearing adherence, all found that, as perceived susceptibility increases, mask wearing non-adherence decreases (i.e., those who perceive themselves to be less susceptible to COVID-19 are more likely to not adhere).

As perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases

Table 50: Studies evidencing that, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Milad and Bogg (2021)	United States	North America	Anglo	High Income
2	Fisher et al. (2020)	United States	North America	Anglo	High Income
3	Datta et al. (2021)	United States	North America	Anglo	High Income
4	Freidin et al. (2021)	Argentina	South America	Latin America	Upper Middle Income

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Perceived risk of exposure to SARS-CoV-2 [$r^2 = 0.15$, $p < 0.01$] was positively correlated to mask wearing but was not a significant factor in the pathway analysis.

United States, Fisher et al. (2020): Fisher et al. (2020) surveyed a representative sample of adults (n = 1,005) in the United States in the month following the government recommendation to wear face coverings. The outcome of interest was the use of face coverings within the previous six weeks. Descriptive statistics showed that 81.8 per cent of those wearing a mask had a perceived susceptibility to getting COVID-19.

United States, Datta et al. (2021): Datta et al. (2021) conducted semi-structured interviews with 16 healthcare professionals on the barriers and facilitators to face mask compliance to influence the development of an intervention to bring about change. The qualitative study identified that a concern for potential exposure to COVID-19 was a motivator for mask wearing.

Argentina, Freidin et al. (2021): Freidin et al. (2021) completed a survey of 578 respondents to assess the predictors of mask wearing using hierarchically organized regressions. The entering order of factors in the regressions was as follows: age, gender, education, contagion risk, illness severity, benefits (mask effectiveness), costs and norms. The model with the greatest predictive validity of variance reported by Freidin et al. (2021) included all of the aforementioned regression factors, explaining 39 per cent of the variance [$p < 0.001$]. Perceived risk of contagion was a significant predictor of mask wearing [$p < 0.05$] with those expressing a greater perceived risk more likely to wear a mask.

Perceived susceptibility to COVID-19 is not associated with mask wearing adherence

Table 51: Studies evidencing that perceived susceptibility to COVID-19 is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Barile et al. (2020)	United States	North America	Anglo	High Income

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States (n = 1,004), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education) and adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intentions to use, and use of, a face covering. No significant association was reported between perceived susceptibility to COVID-19 and intention to wear, or actual wearing of, a cloth face covering.

Conclusions

Table 52: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	As perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases [n, %]	As perceived susceptibility to COVID-19 increases, mask wearing non-adherence increases [n, %]		
Studies	4 [80%]		1 [20%]	5
Studies	4 [80%]	0	1 [20%]	5
Region				
Europe	0	0	0	0
North America	3 [75%]	0	1 [25%]	4

Asia	0	0	0	0
Oceania	0	0	0	0
South America	1 [100%]	0	0	1
Africa	0	0	0	0
Cultural Group				
Anglo	3 [75%]	0	1 [25%]	4
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	1 [100%]	0	0	1
Southern Asia	0	0	0	0
Confucian Asia	0	0	0	0
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	3 [75%]	0	1 [25%]	4
Upper Middle Income	1 [100%]	0	0	1
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the relationship between perceived susceptibility to COVID-19 and mask wearing adherence, 80 per cent [4 out of 5] found perceived susceptibility to be predictive, so that it can be concluded with high confidence that perceived susceptibility is predictive of mask wearing adherence. Of the four studies that found perceived susceptibility to COVID-19 to be predictive of mask wearing adherence, 100 per cent [4 out of 4] found that, as perceived susceptibility increases, mask wearing non-adherence decreases (i.e., those who perceive themselves to be less susceptible to COVID-19 are more likely to not adhere), so that it can be concluded with high confidence that, when perceived susceptibility is predictive of mask wearing non-adherence, the association is negative. Of all the studies, 80 per cent [4 out of 5] found that, as perceived susceptibility increases, mask wearing non-adherence decreases, so that, overall, it can be concluded with high confidence that, as perceived susceptibility increases, mask wearing non-adherence decreases (i.e., those who perceive themselves to be less susceptible to COVID-19 are more likely to not adhere).

In looking for patterns by region, cultural group and income of the countries in the studies, some associations between perceived COVID-19 susceptibility and mask wearing adherence are evident.

Region: Of the studies conducted in North American countries, 75 per cent [3 out of 4] found that, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in North American countries, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived susceptibility to COVID-19 and mask wearing adherence in the context of South American countries [1 study].

There is no evidence to draw conclusions about the relationship between perceived susceptibility to COVID-19 and mask wearing adherence in the contexts of European [0 studies], Asian [0 studies], Oceanian [0 studies] and African [0 studies] countries.

Cultural group: Out of studies conducted in Anglo cultural group countries, 75 per cent [3 out of 4] found that, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in Anglo cultural group countries, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived susceptibility to COVID-19 and mask wearing adherence in the context of Latin American cultural group countries [1 study].

There is no evidence to draw conclusions about the relationship between perceived susceptibility to COVID-19 and mask wearing adherence in the contexts of Germanic European [0 studies], Nordic European [0 studies], Eastern European [0 studies], Latin European [0 studies], Southern Asian [0 studies], Confucian Asian [0 studies], Sub-Saharan African [0 studies] and Middle Eastern [0 studies] cultural group countries.

Income: Of the studies conducted in high income countries, 75 per cent [3 out of 4] found that, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in high income countries, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases.

There is insufficient evidence to draw conclusions about the relationship between perceived susceptibility to COVID-19 and mask wearing adherence in the context of upper middle income countries [1 study].

There is no evidence to draw conclusions about the relationship between perceived susceptibility to COVID-19 and mask wearing adherence in the contexts of lower middle income [0 studies] and low income [0 studies] countries.

REFLECTIVE MOTIVATION
PERCEIVED BEHAVIOURAL CONTROL

6.2.4

Perceived behavioural control is an individual's perception of the ease or difficulty in performing a behaviour; closely related to self-efficacy, which is an individual's perception of their ability and capacity to execute a behaviour. Perceived control over mask wearing adherence was measured as an ordinal variable (i.e., on a scale).

In total, four studies considered the association between perceived behavioural control and mask wearing adherence. Of these, three found that perceived behavioural control was predictive of mask wearing adherence. Of the three studies that found perceived behavioural control was predictive of mask wearing adherence, all found that, as perceived behavioural control increases, mask wearing non-adherence decreases (i.e., those who perceive themselves to have less control over their mask wearing are more likely to not adhere).

As perceived behavioural control increases, mask wearing non-adherence decreases

Table 53: Studies evidencing that, as perceived behavioural control increases, mask wearing non-adherence decreases

	Study	Country	Region	Cultural Group	Income
1	Barile et al. (2020)	United States	North America	Anglo	High Income
2	Fisher et al. (2020)	United States	North America	Anglo	High Income
3	Sun et al. (2021)	China	Asia	Confucian Asia	High Income

United States, Barile et al. (2020): Barile et al. (2020) conducted a cross-sectional survey of adults from the United States (n = 1,004), examining the predictors of intention to wear a face covering, reported use of cloth face coverings and reported use of other face masks such as a surgical mask or N95 respirator, in public. Using an ordinal regression path model utilizing sample weights based on US census characteristics (by gender, age, region, race/ethnicity and education) and adjusted for clustering by state of residence, Barile et al. (2020) report on one mediator (intention to use a cloth face covering) and two outcomes (use of cloth face covering and use of other face covering). The covariates of age, gender and urbanicity were included as predictors of intentions to use, and use of, a face covering. Attitude, in terms of perceived importance of wearing a face covering, significantly increased the intention to use a face covering [OR: 4.65, $p < 0.01$], however, this did not result in significant increases in actual use. Self-efficacy significantly increased the intention to use a face covering [intention – OR: 1.9, $p < 0.001$], however, this did not result in significant increases in actual use.

United States, Fisher et al. (2020): Fisher et al. (2020) surveyed a representative sample of adults (n = 1,005) in the United States in the month following the government recommendation to wear face coverings. The outcome of interest was the use of face coverings within the previous six weeks. Descriptive statistics showed that 83.4 per cent of people found the practice easy, with 78 per cent of them able to use a face covering.

China, Sun et al. (2021): Sun et al. (2021) investigated multiple hypotheses using a cross-sectional design with questionnaires distributed to a convenience sample of 477 international university students studying in China. Sun et al. (2021) predicted that attitude, subjective norm and perceived behavioural control were all positively associated with intention to wear a face mask. Further, Sun et al. (2021) predicted that the effect of subjective norm on intention to use a face mask would be mediated by both attitude towards mask wearing and perceived behavioural control. The hypothesis model was analysed using structural equation modelling; living area, countries where international students were from, and grade were controlled for. Perceived behavioural control was directly and positively related to behavioural intention (perceived behavioural control explained 13.1 per cent of the variance). The effects of living area, countries where international students were living, and grade were controlled.

Perceived behavioural control is not associated with mask wearing adherence

Table 54: Study evidencing that perceived behavioural control is not associated with mask wearing adherence

	Study	Country	Region	Cultural Group	Income
1	Milad and Bogg (2021)	United States	North America	Anglo	High Income

United States, Milad and Bogg (2021): Using a cross-sectional survey design with 500 adult participants, Milad and Bogg (2021) assessed adherence to mask wearing by age, sex, perceived health, political views, personality traits, perceived norms, perceived control, attitudes, self-efficacy, guideline adherence intention, guideline adherence, perceived exposure risk and perceived health risk as predictors of follow-up mask wearing (four to six weeks after the collection of baseline measures). Perceived control was not significantly correlated; self-efficacy was correlated but was not found to be significant in a pathway model [$r^2 = 0.18$, $p < 0.01$].

Conclusions

Table 55: Analysis of evidence by findings, region, cultural group and income

	Predictive [n, %]		Non-predictive [n, %]	Total
	As perceived behavioural control increases, mask wearing non-adherence decreases [n, %]	As perceived behavioural control increases, mask wearing non-adherence increases [n, %]		
Studies	3 [75%]		1 [25%]	4
Studies	3 [75%]	0	1 [25%]	4
Region				
Europe	0	0	0	0
North America	2 [67%]	0	1 [33%]	3

Asia	1 [100%]	0	0	1
Oceania	0	0	0	0
South America	0	0	0	0
Africa	0	0	0	0
Cultural Group				
Anglo	2 [67%]	0	1 [33%]	3
Germanic Europe	0	0	0	0
Nordic Europe	0	0	0	0
Eastern Europe	0	0	0	0
Latin Europe	0	0	0	0
Latin America	0	0	0	0
Southern Asia	0	0	0	0
Confucian Asia	1 [100%]	0	0	1
Sub-Saharan Africa	0	0	0	0
Middle East	0	0	0	0
Income				
High Income	3 [75%]	0	1 [25%]	4
Upper Middle Income	0	0	0	0
Lower Middle Income	0	0	0	0
Low Income	0	0	0	0

Overall: Of the studies that considered the association between perceived behavioural control and mask wearing adherence, 75 per cent [3 out of 4] found that perceived behavioural control is predictive of mask wearing adherence, so that it can be concluded with high confidence that perceived behavioural control is predictive of mask wearing adherence. Of the three studies that found perceived behavioural control to be predictive of mask wearing adherence, 100 per cent [3 out of 3] found that, as perceived behavioural control increases, mask wearing non-adherence decreases (i.e., those who perceive themselves to have less control over their mask wearing are more likely to not adhere). Of all the studies, 75 per cent [3 out of 4] found that, as perceived behavioural control increases, mask wearing non-adherence decreases, so that, overall, it can be concluded with high confidence that, as perceived behavioural control increases, mask wearing non-adherence decreases (i.e., those who perceive themselves to have less control over their mask wearing are more likely to not adhere).

In looking for patterns by region, cultural group and income of the countries in the studies, an association between perceived behavioural control and mask wearing adherence is evident when segmenting by income, but there is insufficient evidence to draw any conclusions on the basis of region and cultural group.

Income: Of the studies conducted in high income countries, 75 per cent [3 out of 4] found that, as perceived behavioural control increases, mask wearing non-adherence decreases, so that it can be concluded with high confidence that, in high income countries, as perceived behavioural control increases, mask wearing non-adherence decreases.

There is no evidence to draw conclusions about the relationship between perceived behavioural control and mask wearing adherence in upper middle income [0 studies], lower middle income [0 studies] and low income [0 studies] countries.

CONCLUSIONS

07

WHO IS MORE LIKELY TO NOT ADHERE TO MASK WEARING MEASURES AND IN WHAT CONTEXT?

7.1

Age

Age is not associated with mask wearing adherence.

Overall, it can be confidently concluded that age is not associated with mask wearing adherence [64 per cent of studies, 7 out of 11].

Regional context: It can be concluded with high confidence that, in North American countries, age is not associated with mask wearing adherence [75 per cent of studies, 6 out of 8].

Cultural group context: It can be concluded with high confidence that, in Anglo cultural group countries, age is not associated with mask wearing adherence [75 per cent of studies, 6 out of 8].

Sex/gender

Males are more likely to not adhere to mask wearing than females.

Overall, it can only be concluded with some confidence that males are more likely to not adhere to mask wearing than females [55 per cent of studies, 6 out of 11].

Education

People who are less educated are more likely to not adhere to mask wearing.

Overall, it can be concluded with some confidence that, as education level increases, mask wearing non-adherence decreases [57 per cent of studies, 4 out of 7].

Income context: It can be concluded with high confidence that, in high income countries, as education level increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Income

Amount of income is not associated with mask wearing adherence.

Overall, it can only be concluded with some confidence that income is not associated with mask wearing adherence [50 per cent of studies, 2 out of 4].

Race/ethnicity

Members of Black ethnic groups are most likely to wear a mask.

Overall, it can be confidently concluded that members of Black ethnic groups are most likely to wear a mask [60 per cent of studies, 3 out of 5].

Marital status

There is insufficient evidence to draw conclusions about the relationship between marital status and mask wearing adherence.

Living area

Whether someone is a rural or urban dweller is not associated with mask wearing adherence.

Overall, it can only be concluded with some confidence that living area is not associated with mask wearing adherence [50 per cent of studies, 2 out of 4].

Health status

There is insufficient evidence to draw conclusions about the relationship between health status and mask wearing adherence.

Access to health care

There is insufficient evidence to draw conclusions about the relationship between access to health care and mask wearing adherence.

WHY ARE PEOPLE MORE LIKELY TO NOT ADHERE TO MASK WEARING MEASURES AND IN WHAT CONTEXT?

7.2

Capability (psychological)

Nothing identified in the rapid evidence review in regard to psychological capability.

Capability (physical)

Nothing identified in the rapid evidence review in regard to physical capability.

Opportunity (social)

Perceived social normative pressure

People who perceive less social normative pressure to wear a mask are more likely to not adhere to mask wearing.

Overall, it can be concluded with high confidence that, as perceived social normative pressure increases, mask wearing non-adherence decreases [86 per cent of studies, 6 out of 7].

Regional context: It can be concluded with high confidence that, in North American countries, as perceived social normative pressure increases, mask wearing non-adherence decreases [80 per cent of studies, 4 out of 5].

Cultural group context: It can be concluded with high confidence that, in Anglo cultural group countries, as perceived social normative pressure increases, mask wearing non-adherence decreases [80 per cent of studies, 4 out of 5].

Income context: It can be concluded with high confidence that, in high income countries, as perceived social normative pressure increases, mask wearing non-adherence decreases [83 per cent of studies, 5 out of 6].

Political ideology

Right-wing people who perceive mask wearing to be less effective are more likely to not adhere to mask wearing.

Overall, it can be concluded with high confidence that right-wing or conservative voters are more likely to not adhere to mask wearing [100 per cent of studies, 5 out of 5].

Regional context: It can be concluded with high confidence that, in North American countries, right-wing or conservative voters are more likely to not adhere to mask wearing [100 per cent of studies, 5 out of 5].

Cultural group context: It can be concluded with high confidence that, in Anglo cultural group countries, right-wing or conservative voters are more likely to not adhere to mask wearing [100 per cent of studies, 5 out of 5].

Income context: It can be concluded with high confidence that, in high income countries, right-wing or conservative voters are more likely to not adhere to mask wearing [100 per cent of studies, 5 out of 5].

Setting

There is insufficient evidence to draw conclusions about the relationship between setting and mask wearing adherence.

Mandating mask wearing

There is insufficient evidence to draw conclusions about the relationship between mandating mask wearing and mask wearing adherence.

Opportunity (physical)

Nothing identified in the rapid evidence review in regard to physical opportunity.

Motivation (reflective)

Perceived mask wearing efficacy

People who perceive mask wearing to be less effective are more likely to not adhere to mask wearing.

Overall, it can be confidently concluded that, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases [60 per cent of studies, 3 out of 5].

Regional context: It can be concluded with high confidence that, in North American countries, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Cultural group context: It can be concluded with high confidence that, in Anglo cultural group countries, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Income context: It can be concluded with high confidence that, in high income countries, as perceived mask wearing efficacy increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Perceived vulnerability to COVID-19

The relationship between perceived vulnerability to COVID-19 and mask wearing adherence is inconclusive.

Overall, the evidence for the relationship between perceived vulnerability to COVID-19 and mask wearing adherence is inconclusive [50 per cent of studies, 2 out of 4, found that, as perceived vulnerability increases, mask wearing non-adherence decreases; 50 per cent of studies, 2 out of 4, found that perceived vulnerability is not predictive of mask wearing adherence].

Perceived susceptibility to COVID-19

People who perceive themselves to be less susceptible to catching COVID-19 are more likely to not adhere to mask wearing.

Overall, it can be concluded with high confidence that, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases [80 per cent of studies, 4 out of 5].

Regional context: It can be concluded with high confidence that, in North American countries, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Cultural group context: It can be concluded with high confidence that, in Anglo cultural group countries, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Income context: It can be concluded with high confidence that, in high income countries, as perceived susceptibility to COVID-19 increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Perceived behavioural control

Those who perceive themselves to have less control over their mask wearing are more likely to not adhere to mask wearing.

Overall, it can be concluded with high confidence that, as perceived behavioural control increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Income context: It can be concluded with high confidence that, in high income countries, as perceived behavioural control increases, mask wearing non-adherence decreases [75 per cent of studies, 3 out of 4].

Motivation (automatic)

Nothing was identified in the rapid evidence review with regard to automatic motivation.

POLICY IMPLICATIONS

08

TARGETING THOSE MORE LIKELY TO NOT ADHERE TO MASK WEARING MEASURES

8.1

Age

No need to target groups on the basis of age

Age was not associated with mask wearing adherence, so policymakers should not target specific support to groups on the basis of their age.

Sex/gender

Support males to wear masks

Policymakers should support males to adhere with mask wearing measures. Further research is required to understand why males are more likely to not adhere to mask wearing in order to inform the design of interventions and policies that can support them to adhere to mask wearing measures.

Education

Support those less educated to wear masks

Policymakers should support less educated people to adhere to mask wearing measures. Further research is required to understand why those less educated are more likely to not adhere to mask wearing in order to inform the design of interventions and policies that can support them to adhere to mask wearing measures.

Income

No need to target groups on the basis of income

Income was not associated with mask wearing adherence, so policymakers should not target specific support to groups on the basis of their income level or socio-economic status.

Race/ethnicity

Learn why members of Black ethnic groups are most likely to wear a mask, but least likely to receive the vaccine

Further research is required to understand why members of Black ethnic groups are most likely to wear a mask, but least likely to receive a COVID-19 vaccine (see equivalent REA on vaccine hesitancy in this series), in particular with regard to perceived vulnerability, perceived susceptibility and trust.

Living area

No need to target groups on the basis of living area

Living area was not associated with mask wearing adherence, so policymakers should not target specific support to rural or urban dwellers.

IMPROVING SOCIAL OPPORTUNITY

8.2

Perceived social normative pressure

Model mask wearing and make mandatory in social settings

That perceived social normative pressure is positively associated with mask wearing adherence presents an opportunity to socially influence mask wearing adherence, certainly in North American countries, Anglo cultural group countries and high income countries.

Modelling

Community leaders should model mask wearing adherence to encourage members of their community to adhere to mask wearing measures. Furthermore, ambassadors from peer groups should be recruited to model mask wearing adherence for groups who are more likely to not adhere to mask wearing measures.

Restrictions

Social normative pressure can be strengthened by restricting access to social venues and social events to those not wearing a mask, although this carries a risk of politicizing COVID-19 and mask wearing.

Political ideology

Depoliticize COVID-19 and diversify messengers promoting mask wearing

That political ideology is predictive of mask wearing non-adherence suggests a need to depoliticize COVID-19 and mask wearing, certainly in North American countries, Anglo cultural group countries and high income countries.

Regulation

Removal of freedoms, such as making mask wearing mandatory, can lead to a widening of the political divide and should be avoided wherever possible.

Communication and modelling

There is a need to diversify the messengers promoting mask wearing, using non-political figures to promote the importance of mask wearing. Also, given that right-wing and conservative voters are more likely to not adhere to mask wearing, right-wing and conservative leaders (especially when not in government) should be involved in promoting mask wearing.

IMPROVING REFLECTIVE MOTIVATION

8.3

Perceived mask wearing efficacy

Communicate how masks work and how effective they are

Policymakers, in particular in North American countries, Anglo cultural group countries and high income countries, should address perceived lack of efficacy as a barrier to mask wearing.

Communication

The role of masks in limiting the spread of COVID-19 should be clearly communicated: they act both as source control devices to block exhaled COVID-19 virus and as filtration to protect the wearer. Source control to block exhaled COVID-19 virus is where, if someone has the virus, she or he can protect others by wearing an N95 mask to block the release of up to 90 per cent of exhaled respiratory particles and droplets into the environment (6). Filtration for wearer protection is where, if someone comes into contact with the virus, wearing an N95 mask can reduce her or his exposure to infectious particles and droplets by between 80 and 90 per cent (6).

The effectiveness of face masks at limiting the release of the virus from wearers, but also protecting them from exposure, has consistently been found to reduce transmission by approximately 70 per cent in real-world settings. For example, following an outbreak of COVID-19 aboard USS *Theodore Roosevelt*, sailors who wore face masks were 70 per cent less likely to be infected than those not using a face mask (7). In a study in Thailand with over 1,000 participants, those who reported always wearing masks in high-risk exposure circumstances were 84 per cent less likely [COR = 0.16, $p < 0.001$] to be infected than those who did not wear a mask (8). In a study of 124 Beijing households with a confirmed case of COVID-19, secondary transmission was 79 per cent lower in the households where masks were worn (9). In a study of schools in Arizona, United States, outbreaks were 3.5 times more likely in schools without mask mandates (10). In a study of a high-exposure event where two symptomatically ill hair stylists in the United States continued to work while wearing masks, coming into direct contact with 139 clients also wearing masks for, on average, approximately 20 minutes, there were no cases of COVID-19 transmission (11). Real-world data such as these, rather than trial data, should be used wherever possible to ensure communications are more meaningful.

Perceived vulnerability to COVID-19

No need to factor in to policy and interventions design

Although there is some evidence that perceived vulnerability is positively associated with mask wearing adherence, the relationship is not conclusive, so policymakers should focus on other factors to support mask wearing adherence.

Perceived susceptibility to COVID-19

Challenge beliefs of insusceptibility to COVID-19 with real-time location-specific data

Given that a lack of perceived susceptibility is positively associated with mask wearing non-adherence, in particular in North American countries, Anglo cultural group countries and high income countries, policymakers can increase adherence to mask wearing measures by educating their populations on the contagiousness of COVID-19 and, therefore, the susceptibility of their populations to COVID-19.

Communication

Regular and meaningful communication of infection rates can challenge perceptions of insusceptibility (e.g., for given locations at a given point in time, how many people are infected).

Perceived behavioural control

Provide free-of-charge masks and reminders to wear masks

Increasing control over mask wearing, certainly in high income countries, can improve adherence with mask wearing measures.

Enablement

Provide free-of-charge masks at entrances to locations where mask wearing is required or advised.

Environmental restructuring

Provide environmental cues, such as signs, to remind people to wear masks.

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