Journal of Public Health | pp. 1–15 | doi:10.1093/pubmed/fdab070

Predictors of attitudes and adherence to COVID-19 public health guidelines in Western countries: a rapid review of the emerging literature

Chelsea Moran[1], David J.T. Campbell[2], Tavis S. Campbell[1], Pamela Roach[3,4], Lyne Bourassa[5], Zoe Collins[5], Marysia Stasiewicz[5], Patrick McLane[6]

[1]Department of Psychology, University of Calgary, Calgary, Canada, T2N 1N4
[2]Departments of Medicine, Community Health Sciences & Cardiac Sciences, Cumming School of Medicine, University of Calgary, Calgary, Canada, T2N 4N1
[3]Department of Community Health Sciences, University of Calgary, Calgary, Canada, T2N 4Z6
[4]Hotchkiss Brain Institute, University of Calgary, Calgary, Canada, T2N 4N1
[5]Health Systems Evaluation & Evidence, Alberta Health Services, Edmonton, Canada, T6G 2J3
[6]Emergency Strategic Clinical Network, Alberta Health Services, Edmonton, Canada, T6G 2J3
Address correspondence to Patrick McLane, E-mail: patrick.mclane@ahs.ca

ABSTRACT

Background Physical distancing, wearing face masks and hand hygiene are evidence-based methods to protect the public from coronavirus disease 2019 (COVID-19) infection. There has been a proliferation of research examining characteristics that can be targeted by public health interventions. This rapid review sought to identify predictors of attitudes toward and adherence to COVID-19 public health guidelines, and identify interventions aiming to improve adherence.

Methods Articles were retrieved from multiple databases (e.g. MEDLINE, CINAHL and medRxiv) on 6 August 2020. Studies were limited to samples collected from Western countries. Studies were classified according to the types of factor (s) examined as independent variables. The consistency of evidence for each factor was scored by two reviewers.

Results In total, 1323 unique articles were identified in the initial search, resulting in 29 studies in the final synthesis. The available evidence suggests individuals who are older, identify as women, trust governments, perceive COVID-19 as threatening and access information through traditional news media are more likely to adhere with COVID-19 public health guidelines. Interventions for improving adherence have not yet been investigated thoroughly, and this review identified only three experimental studies.

Conclusions This review has identified several characteristics that impact attitudes and adherence to COVID-19 public health guidelines.

Keywords adherence, attitudes, COVID-19, face masks, hygiene, physical distancing, protective behaviors, public health guidelines

Background

The incidence of the coronavirus disease 2019 (COVID-19), the infection caused by the virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has dramatically increased throughout the world. The World Health Organization (WHO) declared COVID-19 to be an international pandemic on 11 March 2020. In an effort to control the impact of COVID-19 on public health, national and local governments worldwide have recommended or mandated a variety of mitigation measures. Physical distancing, wearing face masks and hand hygiene are evidence-based non-pharmacological interventions designed to reduce transmission of SARS-CoV-2. Broad public uptake and long-term maintenance of these measures have been identified as essential to reduce transmission and minimize burden on health care systems.[1–3] Recent predictive modelling from

Chelsea Moran, MA, PhD Candidate
David J.T. Campbell, MD, PhD, MSc, FRCPC
Tavis S. Campbell, PhD
Pamela Roach, PhD
Lyne Bourassa, MSc
Zoe Collins, BSc
Marysia Stasiewicz, BA
Patrick McLane, MA, PhD

Canada estimates that without the implementation of public health measures, 64.6% of the population would become infected with COVID-19, and ~3.6% of those infected would die from COVID-19 related illness by January 2022.[4] Behavioral public health measures are crucial to curb infection rates as no curative treatment for COVID-19 is currently available and it is unclear in many jurisdictions when approved vaccines will be widely available to the general population.[5] As such, some form of these protective behaviors may be required into 2022, with risk of pandemic resurgence remaining elevated into 2024.[6]

Behavioral mitigation procedures rely on public adherence to key health behaviors. However, adherence to these measures varies and there is interest in exploring individual-level characteristics that predict adherence to COVID-19 guidelines, which can be targeted by public health messaging and interventions. Dozens of large national and international surveys have been conducted across the world to describe the relationship between various individual characteristics on attitudes and rates of adherence to COVID-19 public health guidelines. There is a need to synthesize the current state of knowledge in order to identify predictive factors that can be targeted by public health interventions, and to highlight gaps in this area.

The purpose of this rapid review is to summarize the emerging literature to provide insight into the following research questions:

(1) What factors impact *attitudes toward* COVID-19 public health guidelines, including physical distancing, wearing face masks and hand hygiene?
(2) What factors impact *adherence to* COVID-19 public health guidelines, including physical distancing, wearing face masks and hand hygiene?
(3) What interventions can create more positive attitudes toward following public health guidelines with the goal of increasing guideline adherence?

Methods

Study design

This study is a rapid review informed by the development protocol for the upcoming Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) rapid review guidelines.[7] A rapid review is a knowledge synthesis methodology that is designed to provide preliminary insight into an urgent research question.[7,8] This methodology is appropriate to generate a preliminary summary COVID-19 behavioral research.

The results of this review were originally reported in the Alberta Health Services COVID-19 Scientific Advisory Group Rapid Evidence Report on Attitudes and Adherence to COVID-19, published on 25 September 2020.[9] The inclusion/exclusion criteria were selected to retrieve studies most applicable to the Canadian context.

Information sources and search strategy

A literature search was conducted by a librarian from the Knowledge Management Department of Alberta Health Services on 6 August 2020. The search was designed to capture articles from the academic and grey literature, including preprints. The search was completed in OVID MEDLINE, PubMed, CINAHL, LitCovid, TRIP PRO, WHO Global research on coronavirus, COVID-19 Primer, National Collaborating Centre for Methods and Tools, medRxiv, bioRxiv, Google and Google Scholar. The MEDLINE search is reproduced in Supplementary Table 1.

Selection process

Titles and abstracts identified in the search were reviewed by the librarian for an initial relevance screening, to exclude studies that were obviously not related to the purpose of the current review. One reviewer then screened the remaining titles and abstracts according to pre-specified inclusion and exclusion criteria (Table 1).

Data extraction

Data extraction was completed by seven individual coders and was not conducted in duplicate due to time constraints. A standardized data extraction form, which was refined throughout the data extraction process, was used to collect information about study design, jurisdiction, sample size, study characteristics, sampling methods, independent variables (i.e. factors) and outcomes, mediating/moderating variables, reference groups used in statistical analyses and results (including effect sizes, confidence intervals and *P*-values).

Synthesis methods

Factors related to attitudes or adherence to COVID-19 public health guidelines were summarized in tabular format. Two independent raters assessed consistency of study results within each factor by examining studies that reported statistically significant results. Factors were labeled as high consistency (>80% of studies show an association of similar strength in the same direction), moderate consistency (50–79% of studies show an association of similar strength in the same direction), low consistency (≤50% of studies

Table 1 Inclusion and exclusion criteria

Element	*Inclusion criteria*	*Exclusion criteria*
Population	• Human participants • Adults (≥18 years) • Residing in North America, Europe, Mexico, Australia or New Zealand or with international scope including any of these countries	• Non-human participants • Children (<18 years) • Residing outside of North America, Europe, Australia or New Zealand
Intervention and comparator	• Interventions intended to improve attitudes toward or adherence to COVID-19 public health guidelines of any kind • Any comparison group	• Biomedical interventions
Predictors	• Any factor that may be related to individual-level behavior and could be used to either inform or act as targets of public health response to promote adherence to COVID-19 behaviors	• Studies reporting exclusively on outcomes related to psychological traits and socio-cultural characteristics
Outcome	• Attitudes toward following or adhering to COVID-19 public health guidelines (i.e. hand hygiene, physical distancing and wearing of face coverings)	• Outcomes related to case incidence, transmission or other COVID-19 related outcomes that are not related to individual-level attitudes or behaviors
Study design	• Primary reports • Studies available in English • Empirical studies published in peer-reviewed journals, grey literature or preprints	• Not available in English • Descriptive studies, study protocols, opinion pieces and review articles • Studies relying on convenience samples of < 1000 where weighting or resampling was not done

show no effect) or not consistent (directions of effect vary). Factors were labeled as having consistent lack of effect when more than half of relevant studies reported no statistically significant effect.

Results

Study selection

A total of 29 studies were included in the final synthesis. Database searches yielded 2562 results before deduplication, resulting in 1323 unique titles and abstracts to be screened. Initial screening resulted in 1101 articles excluded by the librarian, leaving 222 articles for full-text screening by the research team. After this selection process, 69 articles remained and initial data extraction was performed. In an effort to increase the quality of studies included in the synthesis, the study team decided to exclude purely descriptive studies and studies relying solely on convenience sampling methods if the sample size was <1000 participants, and where stratification, weighting or resampling analyses were not undertaken. After reviewing the 69 remaining articles according to the new criteria, 29 articles were retained for full data extraction.

Study characteristics

Study characteristics for the 29 included studies are summarized in Table 2. Studies originated from Europe,[10–18] the USA,[19–26] Canada,[27,28] the UK,[29,30] Australia[31] and Mexico.[32] Further, seven papers reported international samples.[23,33–38] With the exception of one study that only reported 777 869 Twitter 'tweets',[37] the mean number of participants in each study was 5293 (standard deviation = 9105), with median number of 1625 participants (range = 482–37 077). Most studies used cross-sectional survey designs ($k = 22$), whereas other design types included longitudinal surveys ($k = 3$),[14,23,38] quasi-experimental ($k = 1$),[17] experimental designs ($k = 2$)[21,32] and media analysis ($k = 1$).[37] Convenience sampling methods were used in almost all included studies ($k = 14$ convenience samples and $k = 13$ stratified convenience samples), with the exception of two studies that relied on random sampling[14] and quota sampling[34] methods. About one-third of the included studies ($k = 11$) were preprints[10,12,13,15,21,23,28,32,33,36,38] and one

Table 2 Characteristics of included studies

First author, year [type]	*Jurisdiction*	*Study design*	*Population*	*Sample size*[a]	*Sampling method*	*Outcomes, measurement method and details [scoring]*
Al-Hasan et al., 2020 [Peer reviewed]	International	Correlational—cross-sectional survey	Participants from the USA, Kuwait and South Korea	482 (USA 207; Kuwait 181; South Korea 94)	Stratified convenience sample—representative (global survey-deploying firm recruited respondents using age, gender, ethnicity and geographic region-based strata and quota matching processes)	**Adherence to physical distancing** (self-report) **Belief of others' adherence to physical distancing** (self-report) [5-point Likert scale, individual items]
Allington et al., 2020 [Peer reviewed]	United Kingdom	Correlational—cross-sectional survey	Data collected from 3 to 7 April 2020 for Study 1 (18 years or older), 1 and 3 April 2020 for Study 2 and 20 and 22 May 2020 for Study 3 (16–75 years old for studies 2 and 3)	949 (study 1); 2250 (study 2); 2254 (study 3)	Convenience sample (study 1); Stratified random samples—representative (studies 2 & 3) Study 1—recruitment in partnership with CitizenMe, invitations sent to all adult UK panel members. Study 2 & 3—recruitment in partnership with Ipsos-MORI (member of British Polling Council) to a stratified random sample of UK adulted aged 16–75 with quotas to achieve national representativeness with regard to age within gender, region, working status, social grade and education)	**Overall adherence to COVID-19 public health measures** (self-report) Physical distancing: spending as little time as possible outside of home, staying 2 m away from anyone outside of household, meet up with friends or family outside of home (self-report) Isolation: going to work or outside despite having symptoms that could be coronavirus (self-report) Hand washing: Washing hands more often, for 20 s (self-report) [Binary scoring, engagement in 4–5 protective behaviors = Adherence]
Banai et al., 2020 [Preprint]	Croatia	Correlational—cross-sectional survey	Residents of Croatia, 18 years and older Data collected between 15 and 26 May 2020	1882	Convenience sample (direct social media promotion)	**Overall adherence to COVID-19 public health measures** (self-report) Physical distancing: keep 2 m distance in enclosed spaces and at least 1 m in the open, avoid crowded places and avoid meeting with friends Hygiene: wash/disinfect hands regularly and sneeze into elbow [5-point Likert scale, mean of 8 items]
Bridgman et al., 2020 [Peer reviewed]	Canada	Correlational—cross-sectional survey, Qualitative	Residents of Canada, 18 years and older	2022; 2.5 million tweets and 8857 news articles	Stratified convenience sample—representative	**Adherence to physical distancing** (self-report) 10 behaviors: worked form home, avoided bars, restaurants and crowds, avoided grocery store at peak times, avoided in-person contact, stocked up on provisions, kept distance of 2 m, switched to online shopping, avoided domestic travel and avoided public transit. [Binary scoring, Principal Component Analysis to reduce 10 items to 2 dimensions, one of which represented overall adherence to physical distancing]
Brodeur et al., 2020 [Report]	United States	Correlational—cross-sectional survey	US residents who own a cell phone (for mobility data) across 436 counties	1139; Data from 436 US counties	Mobility data: convenience sample (mobile phone users with appropriate settings enabled); General social survey: random, stratified and multi-stage strategy according to Kalsbeek (2016).	**Non-essential travel and distance** (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewelers and clothing stores, within 10 days before and after lockdown orders Percent change in distance travelled between 10 days before and after lockdown orders
Clements, 2020 [Peer reviewed]	United States	Correlational—cross-sectional survey	US residents aged 18 years or older. Data collected on 17 March 2020	1034	Convenience sample (recruited through Amazon Mechanical Turk's [Mturk] online platform that pay remote workers to complete small tasks)	**Hoarding behavior** (cleaning supplies, personal hygiene and food), **attending large group events** of > 50 people and **wearing face masks** (self-report) [Binary scoring, behaviors analyzed separately]
de la Vega et al., 2020 [Peer reviewed]	Spain	Correlational—cross-sectional survey	Residents of Spain	64 (study 1—shopping centre); 640 (study 2—online)	Systematic sampling (study 1—every 3rd person at shopping centre) & Convenience sample (study 2—direct social media recruitment)	**Adherence to safety measures** (details not reported) and **perceived need to stay home** (self-report) [11-point scale, 0–10]
De Neys et al., 2020 [Preprint]	International	Correlational—cross-sectional survey	Residents of > 10 countries Data collected between 2 and 10 April 2020	1657	Convenience sample (direct recruitment through social media, bulletin boards and email lists)	**Current and past adherence to physical distancing** (details NR), **moral condemnation of physical distancing violations** [5-point Likert scale]
Doogan et al., 2020 [Peer reviewed]	International	Correlational—media analysis; Qualitative	Twitter 'tweets' related to COVID-19 across 6 countries between 1 January and 30 April 2020.	777 869 tweets	Convenience sample (Publicly available tweets)	**Public perception and attitudes to COVID-19 public health guidelines** (analysis of frequency of Tweets) Less restrictive measures: personal protection, physical distancing, testing and tracing Restrictive measures: gathering restrictions, lockdowns, travel restrictions and workplace closures.

(Continued)

Table 2 Continued.

First author, year [type]	*Jurisdiction*	*Study design*	*Population*	*Sample size*[a]	*Sampling method*	*Outcomes, measurement method and details [scoring]*
Everett et al., 2020 [Preprint]	United States	Experimental—2 × 4 between-subjects design	Residents of the USA Data collected between 15 and16 March 2020	1032	Post-stratified convenience sample—representative (recruited representative US sample for age, sex and race/ethnicity)	**Intentions to adopt public health behaviors** for next 2 weeks even if do not feel sick and **perception of other's intentions to adopt public heath behaviors** for next 2 weeks (self-report) 5 behaviors: Washing hands, avoiding social gatherings, self-isolating, sharing public health messages and likelihood cancel upcoming vacation they had already paid for (perception of others only) [7-point Likert scale, individual items]
Folmer et al., 2020 [Preprint]	Netherlands	Correlational—successive independent sample survey	Data collected between 8 and 14 May 2020 and 22 and 26 May 2020	984 (8–14 May); 1021 (22–26 May)	Stratified convenience sample—representative (recruited by the Dutch online research panel Motivation for a representative sample)	**Overall adherence to COVID-19 public health guidelines** (self-report) 7 behaviors: tendency to keep safe 1.5 m distance or more from others outside of direct household, neighbors, colleagues at work, friend and family from outside of direct household, others when grocery shopping, others when taking a walk or exercising, others in traffic or public transport. [7-point Likert scale, mean score]
Freeman et al., 2020 [Peer reviewed]	United Kingdom	Correlational—cross-sectional survey	Adults in England 4 and 11 May 2020	2501	Stratified convenience sample—representative (survey managed by Lucid; multiple survey suppliers advertised the survey on social media, news, websites, etc.)	**Overall adherence to COVID-19 public health guidelines** and **COVID-19 medical testing and tracing attitudes** (self-report) Overall self-assessment of following government guidance (present and future intention) Adherence to specific government guidance: staying home and only leaving house for essential journeys, not meeting people outside household even friends and family, no more than one form of exercise a day outside alone or with members of household, stay 2 m apart from other people at all times when going out, not going to work unless absolutely have to, wash hands with soap and water often for at least 20 s and do not touch face. COVID-19 medical testing and tracing: Intention to take diagnostic test if offered, take COVID-19 antibody test if offered, take COVID-19 vaccine if offered, try to stop family and friends from getting the COVID-19 vaccine. Intention to download and use contact tracing app. Wear a facemask outside if advised by the government [5-point Likert scale, individual items]
Goldberg et al., 2020 [Peer reviewed]	United States	Correlational—cross-sectional survey	US residents aged 18 years or older Data collection between 3 and 7 April 2020	3933 (3 April — 1,740; 4 April 4 — 1,745; 5 April — 292; 6 April —154; 7 April — 2)	Stratified convenience sample—representative (national sample recruited by Climate Nexus Polling that utilized several market research panels in the USA to meet quotas matched to census parameters for sex, race, age, education, income and geographic region. Sampling weights used to account for any small deviations from census parameters)	**Worn mask in public** (self-report) [Binary scoring, individual item]
Gutierrez et al., 2020 [Preprint]	Mexico	Experimental—cross-sectional survey	Individuals living in Mexico (78% living in Mexico City)	1022 (date reported condition 508; occurrence data condition 514)	Convenience sample (recruited via email and social media)	**Perceived risk of contagion** associated with attending social gathering of > 100 people and **intention to adhere to physical distancing** based on number of times expected to leave home in the next week (self-report) [Binary, risk of contagion scoring not reported, physical distancing scoring based on threshold (planning to leave house 3 or more times)]
Im & Chen, 2020 [Preprint]	International	Correlational—prospective longitudinal survey	Residents of 123 countries. Data collection between three time periods; (1) from 15 February 2020 to the day before the first day of each country's 100th case, (2) first day of each country's 100th case to 30 days after and (3) from the 31st day after the 100th case to 7 June 2020	14 022 mobility observations	Convenience sample (physical distancing data collected from users who turned on mobile device's location history settings)	**Physical distancing** (mobility data from Google) Reduction in mobility across 6 dimensions: grocery/pharmacy, local/national parks, public transport bugs, retail and recreational areas, residence and workplace. [Mobility compared to pre-COVID-19 rates for average weekday]
Jørgensen et al., 2020 [Preprint]	International	Correlational—prospective longitudinal cohort survey & cross-sectional survey	Residents of 7 countries (Denmark, France, Germany, Hungary, Italy, Sweden, the UK and the USA)	26 508 (cross-sectional sample with one observation); 10 569 (longitudinal panel sample with two observations)	Stratified convenience samples—representative (survey firm quota sampled panel respondents to match population margins for each country resulting in a cross-sectional sample [one assessment] and a panel sample [two assessments])	**Overall adherence to COVID-19 public health guidelines** (self-report) Physical distancing: avoiding crowds, avoiding hugging and kissing people outside of close family, in a room with > 10 people, use of public transport, keep distance from elderly and chronically ill people and careful to keep distance from people outside closest family Hygiene (hand washing or coughing into sleeve) Management: seeking help from professionals or taking medication [All measures were scaled to range from 0 to 1 to create protective behavior index, no other details on scoring reported]

(Continued)

Table 2 Continued.

First author, year [type]	*Jurisdiction*	*Study design*	*Population*	*Sample size*[a]	*Sampling method*	*Outcomes, measurement method and details [scoring]*
Kantor & Kantor, 2020 [Peer reviewed]	United States	Correlational—cross-sectional survey	Residents of the USA	1005	Stratified convenience sample*-representative (survey distributed to a representative US sample stratified by age, sex and race)	**Overall adherence to COVID-19 public health guidelines** over last week (self-report) 11 behaviors: hand washing, hand sanitizing, avoiding handshakes, tissue/elbow sneeze, avoiding face touching, disinfecting surfaces, wearing mask, wearing eye protection, physical distancing, avoiding travel and stay home/quarantine. [5-point Likert scale, dichotomized according to 'always' or 'most of the time' for each behavior]
Knotek II et al., 2020 [Peer reviewed]	USA	Correlational—cross-sectional surveys	US residents aged 18 years or older, fluent in English Data collection between 3 and 7 July 2020	1141	Stratified convenience sample—representative (quota sampling by Qualtrics Research Services to obtain nationally representative US sample)	**Wearing face mask** (in public indoor space) and **likelihood of wearing mask** in grocery store, indoor retail, outdoor retail, restaurant, public park or beach and gym (self-report) [Binary for wearing face mask, 5-point Likert scale for likelihood]
Kuiper et al., 2020 [Preprint]	Netherlands	Correlational—cross-sectional survey	Residents of the Netherlands aged 18 years and older, English speaking Data collection between 7 and 14 April 2020	568	Stratified convenience sample—representative (recruited through the online platform Prolific Academic for representative sample and were redirected to Qualtrics)	**Overall adherence to COVID-19 public health guidelines** (self-report) 5 items: physical distancing (meet people outside of direct household, keep safe distance from people outside direct household, visit others outside of direct household, allow others to visit direct household) and stay at home (apart from engaging in essential activities) [7-point Likert scale, mean of 5 items]
Nivette et al., 2020 [Peer reviewed]	Switzerland	Correlational—prospective longitudinal cohort survey	22 year olds who had been involved previously in the study Data collected from 8 to 15 April 2020	737	Stratified random sample (oversampling disadvantaged schools)	**Overall adherence to COVID-19 public health guidelines** (self-report) Hygiene: avoid touching face, clean/disinfect mobile phone, caught or sneeze into elbow/cloth, wash hands after cough/sneeze and wash hands regularly Physical distancing: adhere to physical distancing, avoid contact with people at risk avoid groups, do not shake hands, only necessary public transport, stay at home and stay at home with symptoms [Binary scoring of each item, sum score of all 13 behaviors for total adherence and separate sum scores for non-adherence to hygiene and physical distancing measures]
Pedersen & Favero, 2020 [Peer reviewed]	United States	Correlational—cross-sectional survey	Residents of the USA. Data collected on 3 April 2020	1449	Convenience sample (paid US survey respondents through crowdworking platform)	**Intention to adhere to physical distancing** and **maximum duration could tolerate physical distancing** (self-report) Physical distancing: meet friends and relative living outside household, make fewest possible trips to grocery store, be at places where other people will also be (café, restaurant, specialty shops and church), avoid social gatherings, encourage others to avoid all social contact [Scale 0–100 for intentions (index score and details of scoring NR) and number of weeks for tolerance]
Pennycook et al., 2020 [Preprint]	International	Correlational—cross-sectional survey	Residents of Canada, UK and USA Data collected on 24 March 2020	1975 (USA 689; UK 642; Canada 644)	Convenience sample (Canada); Stratified convenience sample—representative (quota-sampling in USA and UK)	**Intentions to change behavior in response to COVID-19** (hygiene and physical distancing), **COVID-19 risk perception**, **COVID-19 misperceptions, quality of national leadership response to COVID-19** (self-report) [Intentions: scale 0–100, Risk perceptions: 4-point Likert scale, misperceptions: binary, national leadership: scoring not reported]
Pickup et al., 2020 [Peer reviewed]	International	Correlational—cross-sectional survey	Residents of USA and Canada. Data collected between 20 March and 7 April 2020	USA: 1009, Canada: 9889	Quota samples (USA: Survey disseminated via Lucid, weights benchmarked on Hispanic or not, white or not, educational attainment; Canada: Survey disseminated via Vox Pop Labs, weights based on age group, sex, the highest level of educational attainment, vote recall in the 2019 Canadian federal election and region.)	**Overall adherence to COVID-19 public health guidelines** (self-report) 22 behaviors related to physical distancing, hygiene, travel and wearing masks. [Binary (select all that apply), scored as proportion change (i.e. ratio of number of behaviors selected to the total number of behaviors presented)]
Rothmund et al., 2020 [Preprint]	Germany	Correlational—cross-sectional survey	Residents of Germany.	1575 (general public sample)	Stratified convenience sample—representative (quota sample from general public in Germany); Convenience sample (email recruitment to all virologists and epidemiologists listed on University and University hospital websites in Germany)	**Overall adherence to COVID-19 public health guidelines** and **belief in COVID-19 conspiracies** (self-report) 15 behaviors: Physical distancing (5 items), hygiene (5 items), policy support (5 items, e.g. in favor of closing all schools and universities) [11-point Likert scale, Latent Class Analysis to identify classes of individuals: mainstream, doubters, cautious, deniers according to risk evaluations and COVID-19 knowledge]

(Continued)

Table 2 Continued.

First author, year [type]	*Jurisdiction*	*Study design*	*Population*	*Sample size*[a]	*Sampling method*	*Outcomes, measurement method and details [scoring]*
Seale et al., 2020 [Peer reviewed]	Australia	Correlational—cross-sectional survey	Residents of Australia, 18 years and older). Data collection between 18 and 24 March 2020.	1420	Stratified convenience sample—representative (Online research company Quality Online Research recruited until a representative sample of the Australian population was obtained)	**Physical distancing and hygiene behavior** (self-report) Physical distancing: avoiding crows, public transport and complying with quarantine restrictions Hygiene: hand washing, sanitizing and cleaning surfaces [Binary, carrying out ≥1 behavior in each category]
Soest et al., 2020 [Peer reviewed]	Norway	Correlational—cross-sectional survey	Students at lower secondary level in Oslo. Data collected between 23 April and 8 May 2020.	8116 (COVID survey); 3790 (2018); 19 799 (2020-pre-COVID)	Convenience sample (all students at lower secondary level in Oslo were invited to participate)	**Overall adherence to COVID-19 public health guidelines** (self-report) 4 behaviors: Hand washing/sanitization, avoid shaking hands with or hugging people, kept 1–2 m distance with non-household members and avoided groups of more than five people. [Binary, 5-point Likert scale average scores of 4 or higher classified as high adherence]
Soest et al., 2020 [Preprint]	Canada	Correlational—cross-sectional survey	Residents of Canada (provinces of Alberta and Ontario), 16 years and older and able to speak English Data collected between 6 and 26 April 2020.	1593	Convenience sample (social media and website promotion targeting Alberta and Ontario residents)	**Overall adherence to COVID-19 public health guidelines** (self-report) 7 behaviors: Wearing face mask when leaving home, wear gloves when leaving home, avoid physical contact with other people, hand washing, visiting crowded places, close encounters with non-household members, intention to not isolate if symptomatic or if had known exposure to COVID-19 [participants classified as 'resistant' if indicated that they had visited crowded places, close encounters with non-household members and that they would not self-isolate if symptomatic or if known exposure to COVID-19]
Yousuf et al., 2020 [Peer reviewed]	Netherlands	Quasi-experimental—pretest-posttest survey design	Residents of the Netherlands Data collected on 17 March 2020	16 072 (diagnostic survey); 17 189 (postcampaign survey)	Convenience samples (diagnostic and postcampaign surveys recruited respondents through the national Netherlands' newspaper, De Telegraaf, and used the reach of a Dutch social influencer, Gover Sweep	**Adherence to physical distancing, hand washing and face touching** (self-report) Hand hygiene: wash all areas of hands (backs, fingers, between fingers thumbs, around nail beds, wrists and under nails) and time spent scrubbing (at least 20 s). Physical distancing: spent time with 1–5 people outside of household, spent time with > 5 people outside of household and gone to pubic place where there are > 20 people apart from necessary grocery shopping. Face touching: last 48 h, how often trying not to touch eyes, nose or mouth with hands for hygienic reasons [Likert scale scores, individual items]
Zickfeld *et al.*, 2020 [Peer reviewed]	Norway	Correlational—cross-sectional	Norwegian adults	8676	Convenience sample (survey advertised social media and sent through email lists)	**Overall adherence to COVID-19 public health guidelines** (self-report) 24 behaviors: physical distancing (13 items), hygiene behavior (6 items), prosocial behavior (3 items, e.g. help buying groceries or supplies for those in quarantine) and wearing face past. [Binary, sum score of physical distancing, hygiene and prosocial items]

[a]*Note:* Studies using convenience samples of $n < 1000$ were retained if there was some effort to perform stratified sampling, quota sampling, resampling or any attempt to account for sampling error.

study was a report by an organization (i.e. the Institute of Labor Economics).[19]

Outcome assessment

Outcomes assessed by included studies are reported in Table 2. Outcomes can be classified into three broad categories: (i) adherence to specific COVID-19 protective behaviors; (ii) overall adherence to COVID-19 public health guidelines and (iii) various types of attitudes related to COVID-19 (e.g. intention to adhere, misperceptions, resistance to public messaging, risk perception and belief in conspiracies). Outcomes were typically measured with self-report items, with the exception of two studies using mobility data,[19,38] and one study examining tweets.[37]

Factors impacting attitudes and/or adherence

Studies reported on a wide range of factors, summarized in Fig. 1. Extracted data, including outcomes, effect size and statistical significance, are organized by factor in Supplementary Table 2. Since most included studies primarily examined behavioral outcomes rather than attitudes, we decided to combine all outcome types in the final synthesis for ease of interpretation. The most frequently examined factors related to attitudes or adherence to COVID-19 public health guidelines were age ($k = 14$), sex or gender ($k = 14$), trust in government or authorities ($k = 11$) and education ($k = 11$). Results from these clusters of studies suggest that older age, being female/identifying as a woman, and having greater trust in government or health authorities are all factors that predict

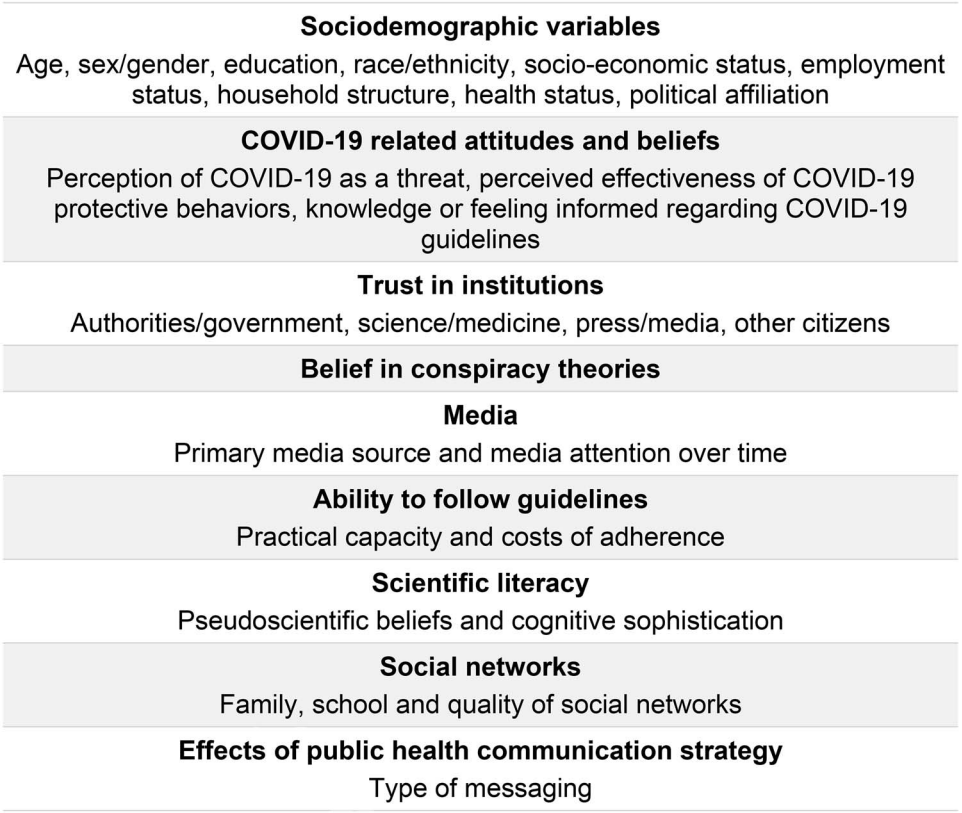

Fig. 1 Summary of most common factors examined in relation to attitude towards and/or adherence to COVID-19 public health recommendations.

greater adherence to COVID-19 public health guidelines, whereas education was not related to adherence or attitudes. Other factors impacting attitudes toward and adherence to COVID-19 guidelines are summarized in Table 3.

Interventions to improve attitudes and/or adherence

Only three studies investigating the effects of interventions on attitudes or adherence to COVID-19 public health recommendations were identified in this review. Yousuf *et al.*[17] conducted an uncontrolled experimental study using convenience samples ($n = 16\,072$ [diagnostic survey] and $n = 17\,189$ [post-campaign survey]) in the Netherlands. They report that exposure to both a targeted video campaign featuring a 22-year-old male social media influencer and a related newspaper article with infographics improved handwashing duration and thoroughness.

Everett *et al.*[21] conducted an experimental study exploring the effects of moralistic messaging and message source on intentions to adhere to public health guidelines using a stratified convenience sample ($n = 1032$). They found that messages stressing duty to wash one's hands (i.e. we are obliged to wash our hands for the sake of others) were more impactful than messages stressing that hand washing is virtuous (i.e. hand washing helps you be your best self). However, significant effects of message type were not observed for physical distancing behaviors.

Gutierrez *et al.*[32] investigated the effects of accurate or estimated COVID-19 death reports on adherence to physical distancing. They randomized 1022 participants to either receive accurate information about COVID-19 death toll (which accounts for delay in death reports) or estimates that do not account for delays in reporting and hence represent an underestimation of the COVID-19 death toll. Participants exposed to estimated death tolls were more likely to report lower intentions of complying with shelter-at-home recommendations and report a lower perceived risk of contagion when compared to participants who received accurate death toll data.

Discussion

This rapid review identified 29 studies investigating predictors of attitudes and/or adherence to COVID-19 protective behaviors or reporting on effects of interventions to improve

Table 3 Summary of evidence for factors predicting adherence to COVID-19 public health guidelines

Factor	*Number of studies*	*Number of statistically significant studies (on all outcomes)*	*Consistency*	*Outcomes examined by included studies*	*Outcomes with statistically non-significant associations*
Age	14	10[a,b]	High (82%)	• Behavior: Overall adherence to COVID-19 public health guidelines [10,16,18,23,28,34] • Behavior: Physical distancing [17,18,20,31,36] • Intentions: Physical distancing [21] • Attitude: Willingness to physically distance [26] • Behavior: Hand hygiene [17,18,31] • Intentions: Hand hygiene [21] • Behavior: Face mask [20] • Intentions: Face mask [25] • Attitude: Moral condemnation of physical distancing violations [36] • Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) [15]	• Behavior: Overall adherence to COVID-19 public health guidelines [16,34] • Behaviour: Physical distancing [20] • Attitude: Willingness to physically distance [26] • Behavior: Hand hygiene [18,31] • Behavior: Face mask [20]
Sex or gender	14	9[a,b]	High (83%)	• Behavior: Overall adherence to COVID-19 public health guidelines [10,16,18,23,28,29,34] • Behavior: Physical distancing [14,17,20,31,36] • Intentions: Physical distancing [21] • Attitude: Willingness to physically distance [26] • Behavior: Hygiene [14,17,31] • Intentions: Hand hygiene [21] • Behavior: Face touching [17] • Attitude: Moral condemnation of physical distancing violations [36] • Behavior: Face mask [20]	• Behavior: Overall adherence to COVID-19 public health guidelines [16,18] • Behavior: Physical distancing [17,20,31] • Behavior: Face mask [20]
Trust or confidence in government or authorities	11	7[a]	High (100%)	• Behavior: Overall adherence to COVID-19 public health guidelines [10,12,16,18,23] • Intentions: Overall adherence to COVID-19 public health guidelines [33] • Behavior: Physical distancing [14,31] • Behavior: Hygiene [14,31] • Behavior: Mask wearing [22] • Attitude: Perceived likelihood that others will adhere to COVID-19 public health guidelines [35] • Behavior: Non-essential visits within 10 days and travel distance [19] • Intentions: Physical distancing [35]	• Behavior: Overall adherence to COVID-19 public health guidelines [16,18] • Behavior: Hygiene [14] • Behavior: Nonessential travel within 10 days [19]
Education	11	3[a,c]	Consistent lack of effect	• Behavior: Overall adherence to COVID-19 public health guidelines [10,16,18,34] • Behavior: Physical distancing [14,17,20,31,36] • Intentions: Physical distancing [21] • Behavior: Face mask [20] • Behavior: Hygiene [14,17,31] • Behavior: Face touching [17] • Intentions: Hand hygiene [21] • Intentions: Share public health messaging on social media [21] • Behavior: Spent more money on cleaning supplies [20] • Attitude: Moral condemnation of physical distancing violations [36] • Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) [15]	• Behavior: Overall adherence to COVID-19 public health guidelines [10,16,18] • Behavior: Physical distancing [14] • Behavior: Hygiene and Physical distancing [31] • Behavior: Physical distancing and Attitude: Moral condemnation of physical distancing violations [36] • Behavior: Hand washing and physical distancing [17] • Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) [15]
Perceiving COVID-19 as a threat	9	6	High (100%)	• Behavior: Overall adherence to COVID-19 public health guidelines [12,13,18] • Intentions: Overall adherence to COVID-19 public health guidelines [33] • Behavior: Physical distancing [11,14,18,31,36] • Behavior: Hygiene[11,14,18,31] • Attitude: Moral condemnation of physical distancing violations [36] • Attitude: Willingness to physically distance [26]	• Behavior: Overall adherence to COVID-19 public health guidelines [18] • Behaviors: Hygiene and Physical distancing [14,31]
Knowledge about pandemic or public health guidelines	9	7	Moderate (78%)	• Behavior: Overall adherence to COVID-19 public health guidelines [12,18,23,28] • Behavior: Physical distancing [14,18,27] • Intentions: Physical distancing [35] • Attitude: Perception of others likelihood to physically distance [35] • Attitude: Willingness to physically distance [26] • Behavior: Hygiene[14,18]	• Behavior: Overall adherence to COVID-19 public health guidelines [12,18]

(Continued)

Table 3 Continued.

Factor	*Number of studies*	*Number of statistically significant studies (on all outcomes)*	*Consistency*	*Outcomes examined by included studies*	*Outcomes with statistically non-significant associations*
Politics	7	4[b]	High (83%)	• Behavior: Overall adherence to COVID-19 public health guidelines [23,34] • Intentions: Overall adherence to COVID-19 public health guidelines [33] • Behavior: Physical distancing [20,27] • Intentions: Physical distancing [21] • Attitude: Perception of other people's intentions to adhere to physical distancing [21] • Intentions: Hand hygiene [21] • Attitude: Misperceptions about COVID-19 risk [33] • Behavior: Non-essential visits [19] • Behavior: Face mask [20]	• Behavior: Physical distancing [20,27] • Behavior: Non-essential visits [19] • Behavior: Face mask [20]
Socio-economic status	7	3[a,b]	High (75%)	• Behavior: Overall adherence to COVID-19 public health guidelines [16,23,34] • Intentions: Overall adherence to COVID-19 public health guidelines [21] • Behavior: Physical distancing [14,20,38] • Behavior: Hygiene[14] • Behavior: Face mask [20]	• Behavior: Overall adherence to COVID-19 public health guidelines [16] • Intentions: Overall adherence to COVID-19 public health guidelines [21] • Behavior: Physical distancing [14,20,38] • Behavior: Face mask [20]
Primary media source	6	4	High (100%)	• Behavior: Overall adherence to COVID-19 public health guidelines [18,24,29] • Behavior: Physical distancing [18,27,29,35] • Attitude: Anticipated duration of physical distancing [26] • Attitude: Perception of others likelihood to physically distance [35] • Behavior: Isolation [29] • Behavior: Hygiene[18]	• Behavior: Overall adherence to COVID-19 public health guidelines and physical distancing • Behavior: physical distancing adherence
Belief in conspiracy theories	5	3[c]	High (100%)	• Behavior: Overall adherence to COVID-19 public health guidelines [10,29,30] • Intentions: Overall adherence to COVID-19 public health guidelines [30,33] • Behavior: Physical distancing [29,30] • Behavior: Isolation [29] • Behavior: Face mask [30] • Behavior: Hand hygiene [29,30] • Attitude: Belief in COVID-19 conspiracy theories • Attitude: Endorsement of official explanations for COVID-19 [30] • Intention: Take COVID test if offered [30] • Intention: Vaccine if offered [30] • Behavior: Download and use contact racing app [30]	• Behavior: Overall adherence to COVID-19 public health guidelines [10] • Attitude: Belief in COVID-19 conspiracy theories [15]
Trust in others	5	2[a]	Not consistent	• Behavior: Overall adherence to COVID-19 public health guidelines [16,23] • Behavior: Physical distancing [14,38] • Behavior: Hygiene[14] • Behavior: Non-essential visits and travel distance [19]	• Behaviour: Overall adherence to COVID-19 public health guidelines [16] • Behavior: Hygiene[14] • Behavior: Non-essential visits and travel distance [19]
Employment status	6	3[c]	Consistent lack of effect	• Behavior: Overall adherence to COVID-19 public health guidelines [24,28] • Intention: Overall adherence to COVID-19 public health guidelines [21] • Behavior: Physical distancing [31] • Behavior: Hygiene [31] • Attitude: Willingness to physically distance [26] • Attitude: Physical distancing anticipated duration [26] • Attitude: Perception of other people's intentions to adhere to COVID-19 public health guidelines [21] • Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) [15]	• Behavior: Overall adherence to COVID-19 public health guidelines [24] • Intentions: Overall adherence to COVID-19 public health guidelines [21] • Behavior: Physical distancing [31] • Behavior: Hygiene [31] • Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) [15]
Race or ethnicity	4	3	Not consistent	• Behavior: Physical distancing [31] • Intentions: Physical distancing [21] • Attitudes: Perception of other people's intentions physically distance [21] • Attitude: Willingness to physically distance • Behavior: Hygiene [31] • Intentions: Hand hygiene [21] • Behavior: Face mask [20] • Attitude: Perception of other people's intentions for hand hygiene	• Behavior: Hygiene and physical distancing [31]

(Continued)

Table 3 Continued.

Factor	*Number of studies*	*Number of statistically significant studies (on all outcomes)*	*Consistency*	*Outcomes examined by included studies*	*Outcomes with statistically non-significant associations*
Perceived effectiveness of protective behaviors recommended in public health guidelines	4	4	High (100%)	• Behavior: Overall adherence to COVID-19 public health guidelines [18,24] • Behavior: Physical distancing [18] • Behavior: Hygiene • Intention: Likelihood of wearing mask [25] • Attitude: Willingness to physically distance [26] • Attitude: Anticipated duration of physical distancing [26]	None
Trust in science, scientists or medicine	4	3	Moderate (75%)	• Behavior: Physical distancing [27,31] • Behavior: Hygiene [31] • Behavior: Non-essential visits and travel distance [19] • Intentions: Overall adherence to COVID-19 public health guidelines [33]	• Behaviors: Non-essential visits and travel distance [19]
Capacity to comply	3	3	High (100%)	• Behavior: Overall adherence to COVID-19 public health guidelines [12,13] • Behavior: Physical distancing [31] • Behavior: Hygiene [31]	None
Household structure	3	1	Moderate (67%)	• Behavior: Overall adherence to COVID-19 public health guidelines [18,28] • Behavior: Physical distancing behavior • Behavior: Hygiene [18,31]	• Behavior: Physical distancing behavior [31] • Behavior: Hygiene [18,31]
Health status	2	0	Consistent lack of effect	• Behavior: Overall adherence to COVID-19 public health guidelines [18] • Behavior: Physical distancing [31] • Behavior: Hygiene [31]	• Behavior: Overall adherence to COVID-19 public health guidelines [18] • Behavior: Physical distancing and hygiene [31]

Notes:

The following factors were only examined by single studies include in this review, and therefore are not included in this table: COVID-19 related experiences (e.g. tested, diagnosed, etc.),[18] Media attention,[37] Prevalence and existing policies,[25] Provincial Residence and [28] Social networks (i.e. family, school and quality of social networks).[14]

Statistical significance was determined based on the alpha level defined by the authors of each included study.

Two independent raters assessed consistency of study results within each factor by examining studies that reported statistically significant results. Factors were labeled as high consistency (>80% of studies show an association of similar strength in the same direction), moderate consistency (50–79% of studies show an association of similar strength in the same direction), low consistency (≤50% of studies show no effect) or not consistent (directions of effect vary). Factors were labelled as having consistent lack of effect when more than half of relevant studies reported no statistically significant effect.

[a]Soest *et al.* (2020) did not report statistical significance and are included in this count as a non-significant result.

[b]Clements (2020) did not report statistical significance and are included in this count as a non-significant result.

[c]Rothmund *et al.* (2020) did not report statistical significance and are included in this count as a non-significant result.

attitudes or adherence. According to these findings, the bulk of the current literature consists of cross-sectional surveys that use convenience sampling methods without correcting for sampling error. Although the initial purpose of this review was to identify factors that impact attitudes toward COVID-19 public health guidelines and factors that impact adherence to these behaviors, it was most productive to examine these outcomes together given the limited scope of evidence available.

Main findings of this study

To date, studies consistently show a positive association between attitudes/adherence and a number of individual characteristics: age, women/female sex, trust in governments and perceived threat of COVID-19. Less frequently mentioned factors positively related to adherence were higher socio-economic status, accessing traditional media sources, trust in science or medicine, perceived effectiveness of guidelines, ability to follow guidelines and larger households. Factors related to decreased adherence to COVID-19 public health guidelines were political conservativism and belief in conspiracy theories. Whereas, education, employment status, trust in others, race and health status were unrelated or inconsistently related to adherence.

This review identified a large gap in the COVID-19 literature: strategies for promoting adherence to public health COVID-19 guidelines have not been robustly investigated to date. Many recommendations for promoting guideline adherence from the literature are speculative since very few interventional studies or quasi-experimental studies have been published to date. Authors generally offer logical suggestions based on inferential findings based on results from

convenience sample surveys, rather than evidence from tested interventions to change attitudes or behaviors. The most promising strategies appear to be communications to increase knowledge about the pandemic and perceived threat of the virus, and improve trust in government or authorities.

What is already known on this topic

Evidence supporting specific messaging and content to enable behavior change in line with COVID-19 public health recommendations is very weak and limited. However, a robust field of literature exists in sociology and psychology regarding behavior change in multiple health and social contexts. This evidence would likely provide more helpful conclusions than the sparse literature currently available related to COVID-19. Reputable sources for guidance include the broader social psychology literature and established frameworks for influencing behavior change (e.g. Behavior Change Wheel[39]), other related public health campaigns which have more rigorous evidence (i.e. hand hygiene) and local community and public engagement activities that engage minority groups, whose voices may be underrepresented in broad population-level surveys. Municipalities may also benefit from relying on their own jurisdictional data collection on public perceptions, which should be rigorously designed and follow guidelines for the appropriate conduct of survey-based research,[40,41] and consider applying the recently released WHO methodology for conducting iterative behavioral insights research on COVID-19.[42,43]

What this study adds

This review identified that those with limited knowledge of the pandemic, those who felt that COVID-19 posed a low risk, and those who were unconvinced of the efficacy of public health guidelines were more likely to exhibit consistently poor adherence. Public health messaging should therefore aim to improve general knowledge of the COVID-19 pandemic, and in particular, focus on the threat posed by the virus and the efficacy of public health guidelines to mitigate risk. Messaging should also be designed to target groups of individuals at higher risk of non-adherence or those with more negative attitudes about COVID-19 public health guidelines. This includes younger people, men, those who self-identify as politically conservative and those who are prone to lower levels of trust in government or science. Although the current review did not identify interventions targeting specific groups at higher risk for non-adherence to COVID-19 measures, an in-depth analysis of communication strategies used by nine democratic jurisdictions identified five broad strategies to enhance population-level adherence that could be applicable to both adherent and non-adherent groups. These include relying on supporting autonomy rather than placing broad orders, linking pandemic measures to existing sociopolitical values and positive emotions, receiving and incorporating feedback from citizens (especially from groups at high risk of non-adherence), communication frameworks emphasizing swift and transparent communication and framing COVID-19 as a democratic challenge requiring mass action.[44]

Government and public health officials should attempt to create an environment that enables adherence to public health guidelines by addressing systemic and structural factors. This review highlighted three studies that consistently found that individuals' capacity to comply with public health guidelines was a significant driving factor in determining adherence levels. Interventions that promote behaviors to limit virus transmission require careful consideration of individual opportunity to adhere to COVID-19 preventive behaviors.[45] For instance, hand hygiene and mask wearing can be supported by providing widespread access to required materials (e.g. tissues, cleaning products, disposable and/or reusable masks) and appropriate facilities for safe disposal and/or decontamination of soiled products. Other behaviors, such as physical distancing and self-isolation when experiencing symptoms, require more complex systemic changes such as changes in spatial layouts of public spaces, access to home-based methods of work and financial support of individuals who do not have access to employment benefits that cover sick days or days taken off work to self-isolate.

Limitations of this study

Most studies identified in this review consisted of cross-sectional survey studies recruited using convenience sampling methods. Non-random sampling approaches compromise representativeness of the sample and produce results that are at high risk of bias, unless sampling error is accounted for through statistical correction. Further, as most studies are point-in-time studies, they do not account for change in drivers of attitudes and behaviors as the pandemic progressed. There were also issues with reporting of results, as some studies only report measures of effect size, frequently without information on statistical significance, while others presented only correlation or regression coefficients. In addition, few studies attended to health equity considerations or accounted for minority population groups' perspectives. A further weakness of the literature is that factors impacting guidelines and outcomes assessed are inconsistently defined and reported, making between-study comparison difficult.

The results of this review should be interpreted in the context of certain limitations. First, as this was a rapid review, our results may not include all published articles or preprints that meet inclusion criteria. It is also possible that information was missed since screening articles for inclusion and data extraction was not performed in duplicate. Second, this review did not include a formal quality assessment of the study design of the included studies. Third, inclusion and exclusion criteria were tailored to retrieve articles that were applicable to the Western context, and only articles written by authors in or including data from North America, Mexico, Europe and Australia were included in this review. Study eligibility criteria were further limited to attitudes and behaviors, which are more modifiable from a public health perspective. Studies that focused exclusively on the effects of personality characteristics (e.g. narcissism, impulsiveness and agreeableness), or on societal characteristics (e.g. individualism and collectivism), on uptake of public health guidelines were excluded. As such, results of this review do not speak to the effects of psychological or societal factors on adherence to COVID-19 guidelines. Furthermore, the review did not search out materials on systems factors (e.g. provision of isolation spaces) and societal factors (e.g. rates of poverty) which may have with a greater impact on public health guideline adherence than individual level factors. Although the results are preliminary, this presents the first effort to map the large volume of studies in this domain and provides direction for future empirical and knowledge synthesis efforts.

Conclusion

This rapid review highlights several factors that are related to attitudes toward and adherence to COVID-19 public health guidelines. The available evidence suggests individuals who are older, identify as women, trust in government, perceive COVID-19 as threatening and access information through traditional news media are more likely to report adherence to COVID-19 public health guidelines. Strategies for promoting adherence to public health guidelines have not yet been investigated thoroughly, but promising avenues for future research include promoting accurate knowledge of pandemic guidelines and highlighting the efficacy of public health guidelines to mitigate the threat posed by COVID-19. Evidence presented in this review is mostly based on cross-sectional survey research using convenience sampling, with most included studies using distinct methods to measure protective behaviors. Future research should utilize experimental designs and more robust sampling techniques to test the effects of public health interventions and messaging on attitudes and behaviors, and investigate targeted approaches for groups that are at increased risk for non-adherence to COVID-19 guidelines.

Acknowledgements

We gratefully acknowledge Rachel Zhao for designing and running the search, as well as Alexandra Bennett, Carla Vetland, Kristal Turner and Armghan Ahmad for their assistance with data extraction. We would also like to thank the committee members who approved the Alberta Health Services COVID-19 Scientific Advisory Group Rapid Evidence Report on Attitudes and Adherence to COVID-19: Braden Mans, Stephanie Hastings, Lynora Saxinger, John Conly, Alexander Doroshenko, Shelley Duggan, Nelson Lee, Elizabeth MacKay, Andrew McRae, Melissa Potestio, James Talbot, Jeremy Slobodan, Brandie Walker and Nathan Zelyas.

Supplementary data

Supplementary data are available at the *Journal of Public Health* online.

Funding

This study was funded through in-kind support from Alberta Health Services. CM was supported by doctoral awards from Vanier Canada, Killam Trusts, and Alberta Innovates and a Training in Research and Clinical Trials in Integrative Oncology (TRACTION) fellowship from the University of Calgary.

Authors' contributions

CM, PM and DC drafted initial manuscript and tables. PM, DC, PR, LB, ZC and MS contributed to study design. LB, ZC and MS completed data extraction. PM, DC, DR, PR, TC and CM contributed to interpretation of results. All authors reviewed and provided feedback on the final draft of the manuscript.

Conflicts of Interests

None to declare.

References

1 Anderson RM, Heesterbeek H, Klinkenberg D *et al.* How will country-based mitigation measures influence the course of the COVID-19 epidemic? *The Lancet* 2020;**395**:931–4.

2 Prather KA, Wang CC, Schooley RT. Reducing transmission of SARS-CoV-2. *Science* 2020;**368**:1422–4. doi: 10.1126/science.abc6197.

3 World Health Organization. *Coronavirus Disease (COVID-19): Advice for the Public*. 2020. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public.

4 Ng V, Fazil A, Waddell LA *et al.* Projected effects of nonpharmaceutical public health interventions to prevent resurgence of SARS-CoV-2 transmission in Canada. *Can Med Assoc J* 2020;**192**:E1053–64. doi: 10.1503/cmaj.200990.

5 Chan EY, Shahzada TS, Sham TS *et al.* Narrative review of non-pharmaceutical behavioural measures for the prevention of COVID-19 (SARS-CoV-2) based on the health-EDRM framework. *Br Med Bull* 2020;**136**(**1**):46–87. doi: 10.1093/bmb/ldaa030.

6 Kissler SM, Tedijanto C, Goldstein E *et al.* Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period. *Science* 2020. doi: 10.1126/science.abb5793.

7 Stevens A, Garritty C, Hersi M, *et al. Developing PRISMA-RR, A Reporting Guideline for Rapid Reviews of Primary Studies (Protocol)*. 2018. https://www.equator-network.org/wp-content/uploads/2018/02/PRISMA-RR-protocol.pdf.

8 Khangura S, Konnyu K, Cushman R *et al.* Evidence summaries: the evolution of a rapid review approach. *Syst Rev* 2012;**1**:10. doi: 10.1186/2046-4053-1-10.

9 Alberta Health Services. *COVID-19 Scientific Advisory Group Rapid Evidence Report: Attitudes and Adherence to COVID-19 Guidelines*. 2020. https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-sag-rapid-evidence-report-attitudes-and-adherence-to-covid-19-guidelines.pdf.

10 Banai IP, Mikloušić I, Banai B. Beliefs in COVID-19 conspiracy theories predict lower level of compliance with the preventive measures both directly and indirectly by lowering trust in government medical officials. *Open Science Framework*[Preprint] 2020. doi: 10.31234/osf.io/yevq7.

11 de la Vega R, Ruíz-Barquín R, Boros S *et al.* Could attitudes toward COVID-19 in Spain render men more vulnerable than women? *Glob Public Health* 2020;**15**:1278–91. doi: 10.1080/17441692.2020.1791212.

12 Folmer CR, Kuiper M, Olthuis E *et al.* Compliance in the 1.5 meter society: longitudinal analysis of citizens' adherence to COVID-19 mitigation measures in a representative sample in the Netherlands. *Open Science Framework*[Preprint] 2020. doi: 10.31234/osf.io/dr9q3.

13 Kuiper ME, de Bruijn AL, Reinders Folmer C *et al.* The intelligent lockdown: compliance with COVID-19 mitigation measures in the Netherlands. *Soc Sci Res Netw*[Preprint] 2020. doi: 10.2139/ssrn.3598215.

14 Nivette A, Ribeaud D, Murray A *et al.* Non-compliance with COVID-19-related public health measures among young adults in Switzerland: insights from a longitudinal cohort study. *Soc Sci Med* 2020;**268**:113370–0. doi: 10.1016/j.socscimed.2020.113370.

15 Rothmund T, Farkhari F, Azevedo F *et al.* Scientific trust, risk assessment, and conspiracy beliefs about COVID-19 - four patterns of consensus and disagreement between scientific experts and the German public. *PsyArXiv*[Preprint] 2020. doi: 10.31234/osf.io/p36w9.

16 Soest T v, Pedersen W, Bakken A *et al.* Compliance with infection control rules among adolescents in Oslo during the COVID-19 pandemic. *Tidsskr Den Nor Legeforening* 2020. doi: 10.4045/tidsskr.20.0449.

17 Yousuf H, Corbin J, Sweep G *et al.* Association of a public health campaign about coronavirus disease 2019 promoted by news media and a social influencer with self-reported personal hygiene and physical distancing in the Netherlands. *JAMA Netw Open* 2020;**3**:e2014323–3. doi: 10.1001/jamanetworkopen.2020.14323.

18 Zickfeld J, Schubert T, Herting AK *et al.* Correlates of health-protective behavior during the initial days of the COVID-19 outbreak in Norway. *Front Psychol* 2020;**11**. doi: 10.31234/osf.io/6vgf4.

19 Brodeur A, Grigoryeva I, Kattan L. Stay-at-home orders, social distancing and trust. *Global Labor Organization (GLO)* 2020. http://hdl.handle.net/10419/217491.

20 Clements JM. Knowledge and behaviors toward COVID-19 among US residents during the early days of the pandemic: cross-sectional online questionnaire. *JMIR Public Health Surveill* 2020;**6**:e19161–1. doi: 10.2196/19161.

21 Everett JAC, Colombatto C, Chituc V *et al.* The effectiveness of moral messages on public health behavioral intentions during the COVID-19 pandemic. *PsyArXiv*[Preprint] 2020. doi: 10.31234/osf.io/9yqs8.

22 Goldberg MH, Gustafson A, Maibach EW *et al.* Mask-wearing increased after a government recommendation: a natural experiment in the U.S. during the COVID-19 pandemic. *Front Commun* 2020;**5**:44. doi: 10.3389/fcomm.2020.0004.

23 Jørgensen FJ, Bor A, Petersen MB. Compliance without fear: individual-level predictors of protective behavior during the first wave of the COVID-19 pandemic. *PsyArXiv* [Preprint] 2020. https://psyarxiv.com/uzwgf/.

24 Kantor BN, Kantor J. Nonpharmaceutical interventions for pandemic COVID-19: a cross-sectional investigation of US general public beliefs, attitudes, and actions. *Front Med* 2020;**7**:384. doi: 10.3389/fmed.2020.00384.

25 Knotek IIES, Schoenle R, Dietrich A *et al.* Consumers and COVID-19: survey results on mask-wearing behaviors and beliefs. *Econ Commentary* 2020;**20**. doi: 10.26509/frbc-ec-202020.

26 Pedersen MJ, Favero N. Social distancing during the COVID-19 pandemic: who are the present and future noncompliers? *Public Adm Rev* 2020;**80**. doi: 10.1111/puar.13240.

27 Bridgman A, Merkley E, Loewen PJ *et al.* The causes and consequences of COVID-19 misperceptions: understanding the role of news and social media. *Harv Kennedy Sch Misinformation Rev* 2020;**1**. doi: 10.37016/mr-2020-028.

28 Underschultz JG, Barber P, Richard D *et al.* What drives resistance to public health measures in Canada's COVID-19 pandemic? A rapid assessment of knowledge, attitudes, and practices. *Soc Sci Res Netw*[Preprint] 2020. doi: 10.2139/ssrn.3605193.

29 Allington D, Duffy B, Wessely S *et al.* Health-protective behaviour, social media usage and conspiracy belief during the COVID-19 public health emergency. *Psychol Med* 2020;1–7. doi: 10.1017/S0033291720000224X.

30 Freeman D, Waite F, Rosebrock L *et al.* Coronavirus conspiracy beliefs, mistrust, and compliance with government guidelines in England. *Psychol Med* 2020;1–13. doi: 10.1017/S0033291720001890.

31 Seale H, Heywood AE, Leask J *et al.* COVID-19 is rapidly changing: examining public perceptions and behaviors in response to this evolving pandemic. *PLoS One* 2020;**15**:e0235112. doi: 10.1371/journal.pone.0235112.

32 Gutierrez E, Rubli A, Tavares T. Information and behavioral responses during a pandemic: evidence from delays in COVID-19 death reports. *Soc Sci Res Netw*[Preprint] 2020. doi: 10.2139/ssrn.3645317.

33 Pennycook G, McPhetres J, Bago B *et al.* Beliefs about COVID-19 in Canada, the U.K., and the U.S.A.: a novel test of political polarization and motivated reasoning. *PsyArXiv*[Preprint] 2020. doi: 10.31234/osf.io/zhjkp.

34 Pickup M, Stecula D, van der Linden C. Novel coronavirus, old partisanship: COVID-19 attitudes and behaviours in the United States and Canada. *Can J Polit Sci* 2020;**53**:357–64. doi: 10.1017/S0008423920000463.

35 Al-Hasan A, Yim D, Khuntia J. Citizens' adherence to COVID-19 mitigation recommendations by the government: a 3-country comparative evaluation using web-based cross-sectional survey data. *J Med Internet Res* 2020;**22**:e20634. doi: 10.2196/20634.

36 De Neys W, Raoelison M, Boissin E *et al.* Moral outrage and social distancing: bad or badly informed citizens? *PsyArXiv*. [Preprint] 2020. https://psyarxiv.com/j9h76.

37 Doogan C, Buntine W, Linger H *et al.* Public perceptions and attitudes toward COVID-19 nonpharmaceutical interventions across six countries: a topic modeling analysis of twitter data. *J Med Internet Res* 2020;**22**:e21419. doi: 10.2196/21419.

38 Im H, Chen C. Social distancing around the globe: cultural correlates of reduced mobility. *PsyArXiv*[Preprint] 2020. doi: 10.31234/osf.io/b2s37.

39 Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci* 2011;**6**:42. doi: 10.1186/1748-5908-6-42.

40 Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet e-surveys (CHERRIES). *J Med Internet Res* 2004;**6**:e34. doi: 10.2196/jmir.6.3e34.

41 Kelley K, Clark B, Brown V *et al.* Good practice in the conduct and reporting of survey research. *International J Qual Health Care* 2003;**15**:261–6. doi: 10.1093/intqhc/mzg031.

42 World Health Organization. Survey tool and guidance: rapid, simple, *flexible behavioural insights on COVID-19*, 2020. https://apps.who.int/iris/handle/10665/333549

43 World Health Organization. *Risk Communication and Community Engagement (RCCE) action plan guidance COVID-19 preparedness and response*. 2020 https://www.who.int/publications-detail-redirect/risk-communication-and-community-engagement-(rcce)-action-plan-guidance.

44 Tworek H, Beacock I, Ojo E. *Democratic Health Communications during COVID-19: A RAPID Response*. UBC Centre for the Study of Democratic Institutions, 2020. https://democracy.arts.ubc.ca/2020/09/14/covid-19/

45 West R, Michie S, Rubin GJ *et al.* Applying principles of behaviour change to reduce SARS-CoV-2 transmission. *Nat Hum Behav* 2020;**4**(**5**):1–9. doi: 10.1038/s41562-020-0887-9.