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

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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

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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. 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. As such, some form of these protective behaviors may be required into 2022, with risk of pandemic resurgence remaining elevated into 2024.

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. A rapid review is a knowledge synthesis methodology that is designed to provide preliminary insight into an urgent research question. 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. 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                                                                 | • Non-human participants                                                            |
|                          | • Adults (≥18 years)                                                                | • Children (<18 years)                                                             |
|                          | • Residing in North America, Europe, Mexico, Australia or New Zealand or with international scope including any of these countries | • 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 | • Biomedical interventions                                                          |
|                          | • Any comparison group                                                              |                                                                                    |
| 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                                                                   | • Not available in English                                                           |
|                          | • Studies available in English                                                      | • Descriptive studies, study protocols, opinion pieces and review articles          |
|                          | • Empirical studies published in peer-reviewed journals, grey literature or preprints | • 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 Australia31 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 sampling14 and quota sampling34 methods. About one-third of the included studies (k = 11) were preprints10,12,13,15,21,23,28,32,33,36,38 and one
| First author, year [type] | Jurisdiction | Study design | Population | Sample size | 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 | 462 (USA 207, Kuwait 184, 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) [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 5 April 2020 for Study 2 and 20 and 22 May 2020 for Study 3 (16–75 years old for studies 2 and 3) | 549 (study 1), 2250 (study 2), 2254 (study 3) | Stratified random samples—representative (study 2 & 3) Study 1—recruitment in partnership with Ösmi, 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 adults 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: keeping 2 m in distance in enclosed spaces and at least 1 m in the open, avoid crowded places and avoid meeting with friends (hygiene: wash/distinct hands regularly and use tissue into elbow) [5-point Likert scale, mean of 8 items] |
| Doogan et al., 2020 [Peer reviewed] | Croatia | Correlational—cross-sectional survey | Residents of Croatia, 18 years and older | 1056 | Convenience sample (direct social media promotion) | Overall adherence to COVID-19 public health measures (self-report) Non-essential travel and distance (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewellers and clothing stores, within 10 days before and after lockdowns-opens Percent change in distance travelled between 10 days before and after lockdowns-opens Hearing behavior: cleaning supplies, personal hygiene and food, amending large group assumed of > 50 people and wearing face masks (self-report) [Binary scoring, behavior analyzed separately] |
| DeNeyse et al., 2020 [Preprint] | Canada | Correlational—cross-sectional survey, Qualitative | Residents of Canada, 18 years and older | 2922, 2.1 million tweets and 8837 news articles | Stratified convenience sample—representative (study 2 & 3) Study 1—recruitment in partnership with Ipsos MORI (member of British Polling Council) to a stratified random sample of UK adults 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) Non-essential travel and distance (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewellers and clothing stores, within 10 days before and after lockdowns-opens Percent change in distance travelled between 10 days before and after lockdowns-opens Hearing behavior: cleaning supplies, personal hygiene and food, amending large group assumed of > 50 people and wearing face masks (self-report) [Binary scoring, behavior analyzed separately] |
| Bridgman et al., 2020 [Peer reviewed] | United States | Correlational—cross-sectional survey | US residents who own a cell phone (for mobility data) across 436 counties | 1130, Data from 436 US counties | Mobility data: convenience sample (mobile phone area with appropriate settings enabled); General social survey: random, stratified and multi-stage strategy according to Kalsbeek (2016) | Overall adherence to COVID-19 public health measures (self-report) Non-essential travel and distance (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewellers and clothing stores, within 10 days before and after lockdowns-opens Percent change in distance travelled between 10 days before and after lockdowns-opens Hearing behavior: cleaning supplies, personal hygiene and food, amending large group assumed of > 50 people and wearing face masks (self-report) [Binary scoring, behavior analyzed separately] |
| Clements, 2020 | United States | Correlational—cross-sectional survey | US residents aged 18 years or older | 1014 | Convenience sample (recruited through Amazon Mechanical Turk [HIT]) online platform that pay remote workers to complete small tasks | Overall adherence to COVID-19 public health measures (self-report) Non-essential travel and distance (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewellers and clothing stores, within 10 days before and after lockdowns-opens Percent change in distance travelled between 10 days before and after lockdowns-opens Hearing behavior: cleaning supplies, personal hygiene and food, amending large group assumed of > 50 people and wearing face masks (self-report) [Binary scoring, behavior analyzed separately] |
| de la Vega et al., 2020 [Preprint] | Spain | Correlational—cross-sectional survey | Residents of Spain | 64 (study 1—shopping centre), 640 (study 2—online) | Systematic sampling (study 1—every 5th person at shopping centre) & Convenience sample (study 2—direct social media recruitment) | Overall adherence to COVID-19 public health measures (self-report) Non-essential travel and distance (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewellers and clothing stores, within 10 days before and after lockdowns-opens Percent change in distance travelled between 10 days before and after lockdowns-opens Hearing behavior: cleaning supplies, personal hygiene and food, amending large group assumed of > 50 people and wearing face masks (self-report) [Binary scoring, behavior analyzed separately] |
| Del Nyse et al., 2020 [Preprint] | International | Correlational—cross-sectional survey | Residents of > 10 countries | 1057 | Convenience sample (direct recruitment through social media, bulletin boards and email list) | Overall adherence to COVID-19 public health measures (self-report) Non-essential travel and distance (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewellers and clothing stores, within 10 days before and after lockdowns-opens Percent change in distance travelled between 10 days before and after lockdowns-opens Hearing behavior: cleaning supplies, personal hygiene and food, amending large group assumed of > 50 people and wearing face masks (self-report) [Binary scoring, behavior analyzed separately] |
| Droogan et al., 2020 [Preprint] | International | Correlational—media analysis, Qualitative | Tweets ‘tweets’ related to COVID-19 across 6 countries between 1 January and 30 April 2020 | 777 849 tweets | Convenience sample (Publicly available tweets) | Overall adherence to COVID-19 public health measures (self-report) Non-essential travel and distance (mobility data from Google) Non-essential visits, such as visits to spas, cinemas, jewellers and clothing stores, within 10 days before and after lockdowns-opens Percent change in distance travelled between 10 days before and after lockdowns-opens Hearing behavior: cleaning supplies, personal hygiene and food, amending large group assumed of > 50 people and wearing face masks (self-report) [Binary scoring, behavior analyzed separately] |

(Continued)
### Table 2 Continued.

| First author, year/ type | Jurisdiction | Study design | Population | Sample size | Sampling method | Outcomes, measurement method and details (scoring) |
|--------------------------|--------------|--------------|-------------|--------------|-----------------|--------------------------------------------------|
| Everett et al., 2020     | United States | Experimental—2 × 4 between-subjects design | Residents of the USA | 1052         | Post-stratified convenience sample—representative (surveyed representative US sample for age, sex and race/ethnicity) | Intentions to adopt public health behaviors for next 2 weeks even if not fully likely and perception of others’ intentions to adopt public health behaviors for next 2 weeks (self-report). 5 Likert: “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] Overall adherence to COVID-19 public health guidelines (self-report). 7 Likert: 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 doing grocery shopping, others when taking a walk or exercising, others in traffic or public transport. [7-point Likert scale, mean score] 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 (presence and future intention). Adherence to specific government guidance: staying home and only leaving home 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 and do not touch face. COVID-19 medical testing and tracing: Intentions 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. Intentions to download and use contact tracing app. Wear a facemask outside if advised by the government [7-point Likert scale, individual items] Worn mask in public (self-report) [Binary scoring, individual item] |
| Folkman et al., 2020     | Netherlands  | Correlational—successive independent sample survey | Data collected between 8 and 14 May 2020 and 22 and 26 May 2020 | 984 (14-15 May, 1022 (22-26 May) | Stratified convenience sample—representative (surveyed by The Dutch online research panel Motivation for a representative sample) | Worn mask in public (self-report) [7-point Likert scale, individual items] |
| Fuhrman et al., 2020     | United Kingdom | Correlational—cross-sectional survey | Adults in England | 2,361 | Stratified convenience sample—representative (survey managed by Lucid), multiple survey suppliers advertised the survey on social media, news, websites, etc.) | Worn mask in public (self-report) [Binary scoring, individual item] |
| Goldberg et al., 2020    | United States | Correlational—cross-sectional survey | US residents aged 18 years or older | 3,055 (3 April — 1,740, 6 April — 1,270, 5 April — 292, 6 April — 154, 7 April — 2) | Stratified convenience sample—representative (sample recruited by Climate Nexus Polling that utilized several market research panels in the USA to meet quotas matched to census parameters for sex, age, education, income and geographic region. Sampling weights used to account for any small deviations from census parameters) | 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 (presence and future intention). Adherence to specific government guidance: staying home and only leaving home 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 and do not touch face. COVID-19 medical testing and tracing: Intentions 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. Intentions to download and use contact tracing app. Wear a facemask outside if advised by the government [7-point Likert scale, individual items] Worn mask in public (self-report) [Binary scoring, individual item] |
| Guzmán et al., 2020      | Mexico       | Experimental—cross-sectional survey | Individuals living in Mexico (75% living in Mexico City) | 1,022 (date reported condition 514) | Convenience sample—surveyed via email and social media | Perceived risk of contagion associated with standing social gathering of > 100 people and intention to adhere to physical distancing based on number of cases expected to cause hemos in the next week (self-report). [Binary, risk of contagion scoring not reported, physical distancing scoring based on threshold (planning to keep safe 1.5 m distance or more from others) |
| Im & Chen, 2020          | International | Correlational—prospective longitudinal survey | Residents of 121 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 39 days after and (3) from the 31st day after the 100th case to 7 June 2020 | 14,022 (physical distancing data collected from users who turned on mobile device location history settings) | Convenience sample—physiological distancing data collected from users who turned on mobile device location history settings | Physical distancing (mobility data from Google) Reduction in mobility across 6 dimensions: grocery/pharmacy, local/national parks, public transport, roads and recreational areas, residences and workplaces [Mobility compared to pre-COVID-19 rates for average weekday] |
| Jürgens et al., 2020     | International | Correlational—prospective longitudinal cohort survey | Residents of 7 countries (Brazil, France, Germany, Hungary, Italy, Sweden, the UK and the USA) | 26,598 (cross-sectional sample with no observations) 10,507 (longitudinal panel sample with two observations) | Stratified convenience sample—representative (survey firm quota sampled panel independently to match population margins for each country resulting in a cross-sectional sample (two assessment) and a panel sample (two assessments) | Overall adherence to COVID-19 public health guidelines (self-report). Physical distancing: avoiding crowds, avoiding hugs and having 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 responses were rescaled to range from 0 to 1 to create protective behavior index, no other details on scoring reported] |

(Continued)
| First author, year (type) | Jurisdiction | Study design | Population | Sample size | Sampling method | Outcomes, measurement method and details (scoring) |
|--------------------------|--------------|--------------|-------------|-------------|----------------|-------------------------------------------------|
| Kantor & Kantor, 2020    | United States | Correlational—cross-sectional survey | Residents of the USA | 1055 | 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, stays at home, allow others to visit household, allow other household members to visit, strategies to reduce transmission (self-report): 11 behaviors: avoid crowds, stay home, avoid travel, use telemedicine, contact tracing, avoid face touching, disinfecting surfaces, wearing mask, eye protection, physical distancing, avoid travel and stay at home, quarantine (5-point Likert scale, dichotomized according to 'often' or 'most of the time' for each behavior) |
| Krotki et al., 2020      | USA          | Correlational—cross-sectional surveys | US residents aged 18 years or older, internet users | 1141 | 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, stays at home, allow others to visit household, allow other household members to visit, strategies to reduce transmission (self-report): 11 behaviors: avoid crowds, stay home, avoid travel, use telemedicine, contact tracing, avoid face touching, disinfecting surfaces, wearing mask, eye protection, physical distancing, avoid travel and stay at home, quarantine (5-point Likert scale, dichotomized according to 'often' or 'most of the time' for each behavior) |
| Kuiper et al., 2020      | Netherlands | Correlational—cross-sectional survey | Residents of the Netherlands aged 18 years and older, English-speaking | 503 | 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, stays at home, allow others to visit household, allow other household members to visit, strategies to reduce transmission (self-report): 11 behaviors: avoid crowds, stay home, avoid travel, use telemedicine, contact tracing, avoid face touching, disinfecting surfaces, wearing mask, eye protection, physical distancing, avoid travel and stay at home, quarantine (5-point Likert scale, dichotomized according to 'often' or 'most of the time' for each behavior) |
| Nisens et al., 2020      | Switzerland | Correlational—prospective longitudinal cohort survey | 22-year-olds who had been invited previously to the study | 737 | Stratified random sample (quota-sampling, disadvantaged populations) | Overall adherence to COVID-19 public health guidelines over last week (self-report): 11 behaviors: hand washing, hand sanitizing, avoiding handshakes, stays at home, allow others to visit household, allow other household members to visit, strategies to reduce transmission (self-report): 11 behaviors: avoid crowds, stay home, avoid travel, use telemedicine, contact tracing, avoid face touching, disinfecting surfaces, wearing mask, eye protection, physical distancing, avoid travel and stay at home, quarantine (5-point Likert scale, dichotomized according to 'often' or 'most of the time' for each behavior) |
| Pedersen & Favero, 2020  | United States | Correlational—cross-sectional survey | Residents of the USA | 1498 | Convenience sample (paid US survey respondents through crowdworking platform) | Intention to adhere to physical distancing: 15-item scale for intention (binary) to adhere to recommended behaviors (binary) scored (0–1) based on number of behaviors adhered to: scales (0–100) for intentions (indices scores and details of scoring NR) and number of weeks for intention adherence measured (0–100) |
| Panayotsev et al., 2020  | International | Correlational—cross-sectional survey | Residents of Canada, UK and USA | 1575 | Stratified convenience sample—representative (survey) distributed to a representative US sample stratified by age, sex and race | Intention to change behavior in response to COVID-19: 5-point Likert scale (Misperceptions) (binary) scored (0–100) for intention (indices scores and details of scoring NR) and number of weeks for intention adherence measured (0–100) |
| Pickup et al., 2020       | International | Correlational—cross-sectional survey | Residents of USA and Canada | 3080 | Convenience sample—random sample (quota-sampling, Canada) | Overall adherence to COVID-19 public health guidelines over last week (self-report): 11 behaviors: hand washing, hand sanitizing, avoiding handshakes, stays at home, allow others to visit household, allow other household members to visit, strategies to reduce transmission (self-report): 11 behaviors: avoid crowds, stay home, avoid travel, use telemedicine, contact tracing, avoid face touching, disinfecting surfaces, wearing mask, eye protection, physical distancing, avoid travel and stay at home, quarantine (5-point Likert scale, dichotomized according to 'often' or 'most of the time' for each behavior) |
| Rothman & al., 2020      | Germany      | Correlational—cross-sectional survey | Residents of Germany | 1575 | Convenience sample (survey) distributed to a representative German public 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, stays at home, allow others to visit household, allow other household members to visit, strategies to reduce transmission (self-report): 11 behaviors: avoid crowds, stay home, avoid travel, use telemedicine, contact tracing, avoid face touching, disinfecting surfaces, wearing mask, eye protection, physical distancing, avoid travel and stay at home, quarantine (5-point Likert scale, dichotomized according to 'often' or 'most of the time' for each behavior) |

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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...
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.\(^\text{17}\) 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.\(^\text{21}\) 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.\(^\text{32}\) 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\(^{b,c}\)                                                | High (82%)  | • Behavior: Overall adherence to COVID-19 public health guidelines 10, 16, 28, 34, 36  
|        |                   |                                                             |             | • 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 24  
|        |                   |                                                             |             | • Behavior: Face mask 28  
|        |                   |                                                             |             | • 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 10, 16, 28, 34, 36  
|        |                   |                                                             |             | • Behavior: Physical distancing 17, 20, 31, 36  
|        |                   |                                                             |             | • 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, 31, 36  
|        |                   |                                                             |             | • 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 24  
|        |                   |                                                             |             | • 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 12, 18, 23, 28, 31, 36  
|        |                   |                                                             |             | • Intentions: Overall adherence to COVID-19 public health guidelines 33  
|        |                   |                                                             |             | • Behavior: Physical distancing 14, 18, 20, 31, 36  
|        |                   |                                                             |             | • Behavior: Face mask 20  
|        |                   |                                                             |             | • Behavior: Hygiene 14, 17, 31  
|        |                   |                                                             |             | • Behavior: Face touching 17  
|        |                   |                                                             |             | • Intentions: Hand hygiene 24  
|        |                   |                                                             |             | • Intentions: Share public health messaging on social media 21  
|        |                   |                                                             |             | • Behavior: Spent more money on cleaning supplies 30  
|        |                   |                                                             |             | • 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 14, 31  
|        |                   |                                                             |             | • Behavior: Nonessential travel within 10 days 19  
|        |                   |                                                             |             | • Behavior: Physical distancing 10, 16  
|        |                   |                                                             |             | • Behavior: Face mask 20  
|        |                   |                                                             |             | • Behavior: Hygiene 14, 31  
|        |                   |                                                             |             | • Behavior: Physical distancing 17, 20, 31  
| 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 24  
|        |                   |                                                             |             | • Intentions: Share public health messaging on social media 21  
|        |                   |                                                             |             | • Behavior: Spent more money on cleaning supplies 30  
|        |                   |                                                             |             | • 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, 28, 34, 36  
|        |                   |                                                             |             | • Behavior: Physical distancing 17, 18, 20, 31, 36  
|        |                   |                                                             |             | • Behavior: Face mask 25  
|        |                   |                                                             |             | • Attitude: Moral condemnation of physical distancing violations 36  
|        |                   |                                                             |             | • Behavior: Face mask 20  
|        |                   |                                                             |             | • Behavior: Overall adherence to COVID-19 public health guidelines 12, 18  
|        |                   |                                                             |             | • Behavior: Hygiene 14, 18  
|        |                   |                                                             |             | • Behavior: Physical distancing 17, 20, 31  
|        |                   |                                                             |             | • Behavior: Face mask 20  
| 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  
| 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 21  
|        |                   |                                                             |             | • Attitude: Perception of others likelihood to physically distance 35  
|        |                   |                                                             |             | • Attitude: Willingness to physically distance 26  
|        |                   |                                                             |             | • Behavior: Hygiene 14, 18  

(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\(^a\)                                                          | High (83%)  | - Behavior: Overall adherence to COVID-19 public health guidelines 23, 34                               | - Behavior: Physical distancing 20, 27                                                                                     |
|                                    |                   |                                                                 |             | - Intentions: Overall adherence to COVID-19 public health guidelines 33                               | - Behavior: Face mask 30                                                                                                  |
|                                    |                   |                                                                 |             | - Behavior: Physical distancing 20, 27                                                               | - Behavior: Non-essential visits 19                                                                                       |
|                                    |                   |                                                                 |             | - 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 risks 33                                                   |                                                                                                                         |
|                                    |                   |                                                                 |             | - 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, 25, 34                        | - Behavior: Overall adherence to COVID-19 public health guidelines 16                                                     |
|                                    |                   |                                                                 |             | - Intentions: Overall adherence to COVID-19 public health guidelines 21                               | - Intentions: Overall adherence to COVID-19 public health guidelines 21                                                   |
|                                    |                   |                                                                 |             | - Behavior: Physical distancing 14, 20, 38                                                           | - Behavior: Physical distancing 14, 20, 38                                                                                 |
|                                    |                   |                                                                 |             | - Behavior: Hygiene 14                                                                                | - Behavior: Face mask 20                                                                                                  |
|                                    |                   |                                                                 |             | - Behavior: Face mask 20                                                                               | - Behavior: Overall adherence to COVID-19 public health guidelines and physical distancing                               |
|                                    |                   |                                                                 |             | - Behavior: Physical distancing 16, 24, 29                                                           | - Behavior: physical distancing                                                                                        |
|                                    |                   |                                                                 |             | - Attitude: Anticipated duration of physical distancing 26                                             | - Attitude: Perception of others likelihood to physically distance 35                                                   |
|                                    |                   |                                                                 |             | - Behavior: Isolation 29                                                                             | - Behavior: Isolation 29                                                                                                |
|                                    |                   |                                                                 |             | - Behavior: Face mask 30                                                                               | - Behavior: Face mask 30                                                                                                |
|                                    |                   |                                                                 |             | - Behavior: Hand hygiene 29                                                                           | - Behavior: Hand hygiene 29                                                                                              |
|                                    |                   |                                                                 |             | - Attitude: Belief in COVID-19 conspiracy theories                                                    | - Attitude: endorsement of official explanations for COVID-19 10                                                          |
|                                    |                   |                                                                 |             | - Attitude: Take COVID test if offered 30                                                               | - Intention: Take COVID test if offered 30                                                                                |
|                                    |                   |                                                                 |             | - Intention: Vaccine if offered 30                                                                     | - Intention: Vaccine if offered 30                                                                                       |
|                                    |                   |                                                                 |             | - Behavior: Download and use contact tracing app 30                                                     | - Behavior: Download and use contact tracing app 30                                                                       |
|                                    |                   |                                                                 |             | - Behavior: Overall adherence to COVID-19 public health guidelines 16, 25, 34                        | - Behavior: Overall adherence to COVID-19 public health guidelines 16                                                     |
|                                    |                   |                                                                 |             | - Behavior: Physical distancing 14, 20, 38                                                           | - Behavior: Hygiene 14                                                                                                |
|                                    |                   |                                                                 |             | - Behavior: Hygiene 14                                                                                | - Behavior: Non-essential visits and travel distance 19                                                                  |
|                                    |                   |                                                                 |             | - Behavior: Face mask 20                                                                               | - Behavior: Face mask 20                                                                                                |
|                                    |                   |                                                                 |             | - Behavior: Hand hygiene 29                                                                           | - Behavior: Hand hygiene 29                                                                                              |
|                                    |                   |                                                                 |             | - Attitude: Belief in COVID-19 conspiracy theories                                                    | - Attitude: Belief in COVID-19 conspiracy theories 15                                                                   |
|                                    |                   |                                                                 |             | - Attitude: Endorsement of official explanations for COVID-19 10                                      | - Intention: Take COVID test if offered 30                                                                                |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Intention: Take COVID test if offered 30                                                                                |
|                                    |                   |                                                                 |             | - Behavior: Overall adherence to COVID-19 public health guidelines 16, 25, 34                        | - Behavior: Overall adherence to COVID-19 public health guidelines 16                                                     |
|                                    |                   |                                                                 |             | - Behavior: Physical distancing 14, 20, 38                                                           | - Behavior: Hygiene 14                                                                                                |
|                                    |                   |                                                                 |             | - Behavior: Hygiene 14                                                                                | - Behavior: Non-essential visits and travel distance 19                                                                  |
|                                    |                   |                                                                 |             | - Behavior: Face mask 20                                                                               | - Behavior: Face mask 20                                                                                                |
|                                    |                   |                                                                 |             | - Behavior: Hand hygiene 29                                                                           | - Behavior: Hand hygiene 29                                                                                              |
|                                    |                   |                                                                 |             | - Attitude: Belief in COVID-19 conspiracy theories                                                    | - Attitude: Belief in COVID-19 conspiracy theories 15                                                                   |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Intention: Take COVID test if offered 30                                                                                |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Trust in others 8\(^a\)                                                                                                |
|                                    |                   |                                                                 |             | - Employment status 6\(^a\)                                                                           | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Behavior: Overall adherence to COVID-19 public health guidelines 24, 28                           | - Behavior: Overall adherence to COVID-19 public health guidelines 24                                                     |
|                                    |                   |                                                                 |             | - Behavior: Physical distancing 31                                                                   | - Behavior: Physical distancing 31                                                                                       |
|                                    |                   |                                                                 |             | - Behavior: Hygiene 31                                                                               | - Behavior: Hygiene 31                                                                                                |
|                                    |                   |                                                                 |             | - Attitude: Willingness to physically distance 26                                                     | - Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) 15                      |
|                                    |                   |                                                                 |             | - Attitude: Physical distancing anticipated duration 26                                               | - Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) 15                      |
|                                    |                   |                                                                 |             | - Attitude: Perception of other people's intentions to adhere to COVID-19 public health guidelines 21 | - Trust in others 8\(^a\)                                                                                                |
|                                    |                   |                                                                 |             | - Attitude: Underestimation of risk (i.e. deniers) and overestimation of risk (i.e. cautious) 15      | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Employment status 6\(^a\)                                                                                              |
|                                    |                   |                                                                 |             | - Trust in others 8\(^a\)                                                                            | - Employment status 6\(^a\)                                                                                              |
| Race or ethnicity                   | 4                 | 3\(^a\)                                                          | Not consistent | - Behavior: Physical distancing 31                                                                   | - Behavior: Hygiene and physical distancing 31                                                                       |
|                                    |                   |                                                                 |             | - Intentions: Physical distancing 21                                                                   | - Intention: Physical distancing 21                                                                                       |
|                                    |                   |                                                                 |             | - Attitudes: Perception of other people's intentions physically distance 21                          | - Attitudes: Perception of other people's intentions physically distance 21                                              |
|                                    |                   |                                                                 |             | - Attitude: Willingness to physically distance 26                                                     | - Attitude: Willingness to physically distance 26                                                                          |
|                                    |                   |                                                                 |             | - Behavior: Hygiene 31                                                                               | - Behavior: Hygiene 31                                                                                                |
|                                    |                   |                                                                 |             | - Intention: Hand hygiene 21                                                                          | - Intention: Hand hygiene 21                                                                                            |
|                                    |                   |                                                                 |             | - Behavior: Face mask 20                                                                               | - Behavior: Face mask 20                                                                                                |
|                                    |                   |                                                                 |             | - Attitude: Perception of other people's intentions for hand hygiene                                | - Attitude: Perception of other people's intentions for hand hygiene                                                 |
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 preventive behaviors recommended in public health guidelines | 4 | 4 | High (100%) | Behavior: Overall adherence to COVID-19 public health guidelines | None |
| Trust in science, scientists or medicine | 4 | 3 | Moderate (75%) | Behavior: Physical distancing | Behavior: Non-essential visits and travel distance |
| Capacity to comply | 3 | 3 | High (100%) | Behavior: Overall adherence to COVID-19 public health guidelines | None |
| Household structure | 3 | 1 | Moderate (67%) | Behavior: Overall adherence to COVID-19 public health guidelines | Behavior: Physical distancing behavior |
| Health status | 2 | 0 | Consistent lack of effect | Behavior: Overall adherence to COVID-19 public health guidelines | None |

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.), Media attention, Prevalence and existing policies, Provincial Residence and Social networks (i.e. family, school and quality of social networks).

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 labeled as having consistent lack of effect when more than half of relevant studies reported no statistically significant effect.

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 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 conservatism and belief in conspiracy theories. Whereas, education, employment status, trust in others, race and health status were unrelated or inconsistently related to adherence.

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 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 conservatism 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, Lorny 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.

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