



Using social and behavioural science to support COVID-19 pandemic response

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The COVID-19 pandemic represents a massive global health crisis. Because the crisis requires large-scale behaviour change and places significant psychological burdens on individuals, insights from the social and behavioural sciences can be used to help align human behaviour with the recommendations of epidemiologists and public health experts. Here we discuss evidence from a selection of research topics relevant to pandemics, including work on navigating threats, social and cultural influences on behaviour, science communication, moral decision-making, leadership, and stress and coping. In each section, we note the nature and quality of prior research, including uncertainty and unsettled issues. We identify several insights for effective response to the COVID-19 pandemic and highlight important gaps researchers should move quickly to fill in the coming weeks and months.

In December 2019, a new coronavirus (SARS-CoV-2) emerged, sparking an epidemic of acute respiratory syndrome (COVID-19) in humans, centred in Wuhan, China¹. Within three months, the virus had spread to more than 118,000 cases and caused 4,291 deaths in 114 countries, leading the World Health Organization to declare a global pandemic. The pandemic has led to a massive

global public health campaign to slow the spread of the virus by increasing hand washing, reducing face touching, wearing masks in public and physical distancing.

While efforts to develop pharmaceutical interventions for COVID-19 are under way, the social and behavioural sciences can provide valuable insights for managing the pandemic and its

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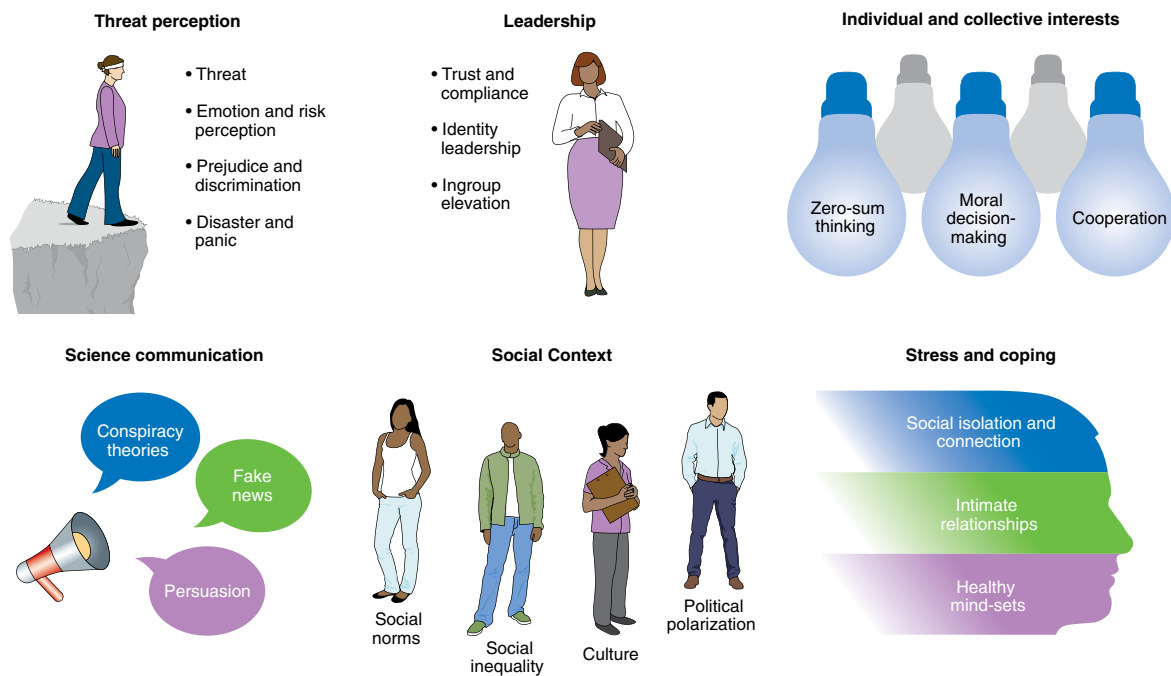


Fig. 1 | Infographic depicting a selection of topics from the social and behavioural sciences relevant during a pandemic. Topics covered here include threat perception, social context, science communication, individual and collective interests, leadership, and stress and coping.

impacts. We discuss topics that are broadly relevant to numerous stages of the current pandemic to help policy-makers, leaders and the public better understand how to manage threats, navigate different social and cultural contexts, improve science communication, align individual and collective interests, employ effective leadership and provide social and emotional support (see Fig. 1 for summary). For each area, we highlight relevant insights, discuss implications for policy makers, leaders and the public (Box 1) and note areas for future research.

Due to space constraints, this paper provides a brief summary of each topic. Research topics discussed here were identified by the corresponding authors as potentially relevant to pandemic response and thus are not exhaustive (for a review of research on specific actions, such as handwashing, face-touching and self-isolation, see ref. ²). Furthermore, research on these topics is ongoing and, in many cases, far from settled. We have highlighted relevant findings in each area as well as critical gaps in the literature. Insights and implications for policy should be interpreted with caution because there is very little published social science research on the current pandemic. Thus, our discussion often draws from different circumstances than the current pandemic (for example, laboratory experiments examining hypothetical scenarios), and the quality of the evidence cited varies substantially (for example, correlational studies vs field experiments; single studies vs systematic reviews of substantial evidence). In the sections that follow, we try to describe the quality of evidence to facilitate careful, critical engagement by readers. We call for the scientific community to mobilize rapidly to produce research to directly inform policy and individual and collective behaviour in response to the pandemic.

Threat perception. Historically, infectious diseases have been responsible for the greatest human death tolls. For example, the bubonic plague killed approximately 25% of the European population³. In this section, we discuss how people are likely to perceive and respond to threats and risk during a pandemic and downstream consequences for decision-making and intergroup relations.

Threat. One of the central emotional responses during a pandemic is fear. Humans, like other animals, possess a set of defensive systems for combating ecological threats^{4,5}. Negative emotions resulting from threat can be contagious⁶, and fear can make threats appear more imminent⁷. A meta-analysis found that targeting fears can be useful in some situations, but not others: appealing to fear leads people to change their behaviour if they feel capable of dealing with the threat, but leads to defensive reactions when they feel helpless to act⁸. The results suggest that strong fear appeals produce the greatest behaviour change only when people feel a sense of efficacy, whereas strong fear appeals with low-efficacy messages produce the greatest levels of defensive responses.

Another challenge is that people often exhibit an ‘optimism bias’: the belief that bad things are less likely to befall oneself than others. While optimism bias may be useful for avoiding negative emotions⁹, it can lead people to underestimate their likelihood of contracting a disease¹⁰ and to therefore ignore public health warnings¹¹. Communication strategies must strike a balance between breaking through optimism bias without inducing excessive feelings of anxiety and dread.

Emotion and risk perception. Sound health decisions depend on accurate perceptions of the costs and benefits of certain choices for oneself and for society^{12,13}. Emotions often drive risk perceptions, sometimes more so than factual information^{14,15}. An emotional response to a risky situation can influence thinking in two stages¹⁶. First, the emotion’s quality (for example, positive vs negative) focuses people on congruent information (for example, negative information when feeling negative). That information, rather than the feeling itself, is then used to guide judgment at the second stage. For example, smokers exposed to more negative emotional health warnings experienced more negative emotion toward warnings and smoking, spent more time examining warnings and recalled more risks, with subsequent effects on risk perception and quitting intentions^{17,18}. As negative emotions increase, people may rely on negative information about COVID-19 more than other information to make decisions.

Box 1 | Social scientific insights for COVID-19 pandemic response

We highlight some insights for public health experts, policy makers, and community leaders.

- A shared sense of identity or purpose can be encouraged by addressing the public in collective terms and by urging ‘us’ to act for the common good.
- Identifying sources (for example, religious or community leaders) that are credible to different audiences to share public health messages can be effective.
- Leaders and the media might try to promote cooperative behaviour by emphasizing that cooperating is the right thing to do and that other people are already cooperating.
- Norms of prosocial behaviour are more effective when coupled with the expectation of social approval and modelled by in-group members who are central in social networks.
- Leaders and members of the media should highlight bipartisan support for COVID-related measures, when they exist, as such endorsements in other contexts have reduced polarization and led to less-biased reasoning.
- There is a need for more targeted public health information within marginalized communities and for partnerships between public health authorities and trusted organizations that are internal to these communities.
- Messages that (i) emphasize benefits to the recipient, (ii) focus on protecting others, (iii) align with the recipient’s moral values, (iv) appeal to social consensus or scientific norms and/or (v) highlight the prospect of social group approval tend to be persuasive.
- Given the importance of slowing infections, it may be helpful to make people aware that they benefit from others’ access to preventative measures.
- Preparing people for misinformation and ensuring they have accurate information and counterarguments against false information before they encounter conspiracy theories, fake news, or other forms of misinformation, can help inoculate them against false information.
- Use of the term ‘social distancing’ might imply that one needs to cut off meaningful interactions. A preferable term is ‘physical distancing’, because it allows for the fact that social connection is possible even when people are physically separated.

In the case of strong emotional reactions, people may also ignore important numeric information such as probabilities¹⁹ and a problem’s scope²⁰. Negative framing captures attention, especially for people who are less mathematically skilled²¹. The media usually report on COVID-19 negatively—for example, by reporting the number of people infected and those who die—as opposed to those who recover or experience only mild symptoms. This may increase negative emotion and sensitize people to otherwise neglected risks for themselves or others. Research is needed to determine whether a more positive frame could educate the public and relieve negative emotions while increasing public health behaviours.

Prejudice and discrimination. The experience of fear and threat has ramifications not only for how people think about themselves, but also how they feel about and react to others—in particular, out-groups. For instance, being threatened with disease is often associated with higher levels of ethnocentrism²²; greater fear and perceived threat are associated with greater intolerance and punitive attitudes toward out-groups^{23–25}. Highlighting group

boundaries can undermine empathy with those who are socially distant^{26,27} and increase dehumanization²⁸ or punishment²⁹.

The bubonic plague, for example, unleashed massive violence in Europe, including the murder of Catalans in Sicily, clerics and beggars in some locations, and pogroms against Jews, with over a thousand communities eradicated³⁰. Although not every pandemic leads to violence, disease threat can nonetheless give rise to discrimination and violence against stigmatized or scapegoated groups. Already, there have been reports of physical attacks on ethnic Asian people in predominantly White countries, and some government officials mis-characterize SARS-CoV-2 as the ‘Wuhan’ or ‘Chinese virus’³¹.

Conversely, a global pandemic may also create opportunities to reduce religious and ethnic prejudice. Coordinated efforts across individuals, communities and governments to fight the spread of disease can send strong signals of cooperation and shared values, which could facilitate reorganization of previously considered out-groups and in-groups into a single community with a common destiny. This ‘superordinate categorization’ is most effective when everyone is of equal status³². These cooperative acts are already unfolding in the current pandemic. For example, 21 countries donated medical supplies to China in February, and China has reciprocated widely. Highlighting events like these could improve out-group attitudes³³ and foster further international cooperation.

Disaster and ‘panic’. There is a common belief in popular culture that, when in peril, people panic, especially when in crowds. That is, they act blindly and excessively out of self-preservation, potentially endangering the survival of all³⁴. This idea has been used to explain responses to the current COVID-19 outbreak, most commonly in relation to the notion of ‘panic buying’. However, close inspection of what happens in disasters reveals a different picture. Certainly, some people do act selfishly and some, especially those who are particularly vulnerable, may experience more distress. But cooperation and orderly, norm-governed behaviour are common across a range of emergencies and disasters; and there are many instances when people display remarkable altruism³⁵. There is already evidence that mutual aid groups among the public have become widespread in response to Covid-19³⁶. Indeed, in fires³⁷ and other natural hazards³⁸, people are less likely to die from over-reaction than from under-reaction, that is, not responding to signs of danger until it is too late.

In fact, the concept of ‘panic’ has largely been abandoned by researchers because it neither describes nor explains what people usually do in disaster³⁹. Instead, the focus has shifted to the factors that explain why people cooperate rather than compete in response to a crisis³⁵. One of these factors is an emerging sense of shared identity and concern for others, which arises from the shared experience of being in a disaster⁴⁰. This feeling can be harnessed by addressing the public in collective terms and by urging ‘us’ to act for the common good⁴¹.

Conversely, the sense of shared identity can be undermined by representing others as competitors. This can happen with images of empty shelves and stories of panic buying, which suggest that others are only looking out for themselves, thus prompting a desire for doing the same. Stocking up on supplies is adaptive in preparation for potential self-isolation⁴². However, use of the notion of panic can be actively harmful. News stories that employ the language of panic often create the very phenomena that they purport to condemn. They can foster the very individualism and competitiveness that turns sensible preparations into dysfunctional stockpiling and undermine the sense of collective purpose which facilitates people supporting one another during an emergency.

Social context

Slowing viral transmission during pandemics requires significant shifts in behaviour. Various aspects of social and cultural contexts influence the extent and speed of behaviour change. In this

section, we describe how aspects of the social context, such as social norms, social inequality, culture and polarization, may help decision-makers identify risk factors and effectively intervene.

Social norms. People's behaviour is influenced by social norms: what they perceive that others are doing or what they think that others approve or disapprove of⁴³. A large literature has distinguished different motives for conformity to norms, including the desire to learn from other people and to gain affiliation or social approval^{43,44}. Although people are influenced by norms, their perceptions are often inaccurate⁴⁵. For example, people can underestimate health-promoting behaviours (for example, hand washing⁴⁶) and overestimate unhealthy behaviors⁴⁷.

Changing behaviours by correcting such misperceptions can be achieved by public messages reinforcing positive (for example, health-promoting) norms. Providing accurate information about what most people are doing is likely to be helpful if what most people are doing is desirable (health-promoting). But if what most people are doing is not desirable, providing purely descriptive normative information can backfire by reducing positive behaviours among people who already engage in them, unless it is accompanied by information signalling that most people approve of these actions (prescriptive as opposed to descriptive norms)^{48,49}. Perceived norms are also most influential when specific to others with whom common identities are shared⁵⁰, including for the spread of health behaviors⁵¹. Therefore, messages that provide in-group models for norms (for example, members of your community) may therefore be most effective.

Social networks can amplify the spread of behaviours that are both harmful and beneficial during an epidemic, and these effects may spread through the network to friends, friends' friends and even friends' friends' friends⁵². The virus itself spreads from person to person, and since people centrally located in networks come into contact with more people, they are often among the first to be infected⁵³. But these very same central people may be instrumental in slowing the disease because they can spread positive interventions like hand washing and physical distancing by demonstrating them to a wide range of people⁵⁴. Some research suggests that a larger proportion of interventions can come not from direct effects on people who receive the intervention, but from indirect effects on their social contacts who copied the behavior⁵⁵. We may therefore leverage the impact of any behaviour change effort by targeting well-connected individuals and making their behaviour change visible and salient to others.

Another way to leverage the impact of norms falls under the general category of 'nudges'^{56,57}, which influence behaviour through modification of choice architecture (i.e., the contexts in which people make decisions). Because people are highly reactive to the choices made by others, especially trusted others, an understanding of social norms that are seen as new or emerging can have a positive impact on behavior⁵⁸. For instance, a message with compelling social norms might say, 'the overwhelming majority of people in your community believe that everyone should stay home'. Nudges and normative information can be an alternative to more coercive means of behaviour change or used to complement regulatory, legal and other imposed policies when widespread changes must occur rapidly.

Social inequality. Inequalities in access to resources affect not only who is at greatest risk of infection, developing symptoms or succumbing to the disease, but also who is able to adopt recommendations to slow the spread of the disease. The homeless cannot shelter in place⁵⁹, families in housing without running water cannot wash their hands frequently⁶⁰, people who are detained by a state (for example, in jails, prisons, immigrant detention centres or refugee camps) may lack space to implement physical distancing,

people without health insurance may delay or avoid seeking testing or treatment, people who rely on public transportation cannot always avoid large crowds and low-wage workers are often in occupations (for example, service, retail, cleaning, agricultural labour) where remote work is impossible and employers do not offer paid sick leave⁶¹. Economic disadvantage is also associated with the pre-existing conditions associated with higher morbidity rates once infected, such as compromised immune systems, diabetes, heart disease and chronic lung diseases like asthma and chronic obstructive pulmonary disease⁶². We expect that, as in natural hazards, the economically disadvantaged will be most likely to be exposed to the hazard, most susceptible to harm from it and most likely to experience negative outcomes from it^{63,64}.

Issues of economic disadvantage intersect with issues of race and ethnicity. Members of minority communities (such as blacks, Latinos and American Indians/Alaska Natives in the US) are disproportionately found among the homeless⁵⁹, the detained, the workers in high public contact but low-benefit occupations⁶⁵, and those with prior health conditions that make them more vulnerable^{66,67}. Because social networks tend to be racially differentiated⁶⁸, members of minority communities who contract the disease may become vectors of transmission to others in their racial and ethnic communities⁶⁹.

Economic position and racial inequality are also associated with levels of trust in social institutions, including the healthcare system. Racial and ethnic minority communities, in particular, have both historical and contemporary experiences of discrimination, leading to distrust^{70–74}. Members of these communities may be more likely to be wary about the public health information they receive, less willing to adopt recommended safety measures and potentially more susceptible to 'fake news'. This suggests the need for more targeted public health information and for partnerships between public health authorities and trusted organizations that are internal to these communities.

Culture. A sense of the self as independent versus interdependent with others is a dimension of cultural variation⁷⁵. Western European and North American cultures that endorse individualism⁷⁶ are considered independent, whereas most other cultures share a stronger commitment to collectives such as country, tribe and family and are considered interdependent^{77,78}. While medical policies are different across societies, some differences in the response to the pandemic may be better described as cultural, and many of those have a linkage to the dimension of independence vs interdependence. First, the priority given to obligations and duties in Asian societies may motivate individuals to remain committed to social norms while suppressing personal desires⁷⁹. Second, Asians may more readily recognize unobservable situational influences on viral infection, like herd immunity⁸⁰. Third, social norms and conventions in North America and much of Western Europe tend to positively value the expressivity of the self (for example, kissing, hugging, direct argumentation), relative to Asia⁸¹. This is another reason why interpersonal transmission of the virus could be more likely in independent cultures than in interdependent cultures.

Another, related, dimension of cultural variance is a society's 'tightness' vs 'looseness'. Research has found that tight cultures, such as those of Singapore, Japan and China, have strict social norms and punishments for deviance, while loose cultures, such as the US, Italy and Brazil, have weaker social norms and are more permissive^{82,83}. Tight nations often have extensive historical and ecological threats, including greater historical prevalence of natural hazards, invasions, population density and pathogen outbreaks^{82,84}. From an evolutionary perspective, when groups experience collective threats, strict rules may help them to coordinate to survive^{82,85}. Therefore, the spread of COVID-19 infections may tighten communities. Cultures accustomed to prioritizing freedom over security may also have

more difficulty coordinating in the face of a pandemic. It may also be relevant that communities negotiate social norms so that there is a balance between freedom and constraint, or 'tight-loose ambidexterity'⁸⁶. Tight rules regarding social distancing are critical, yet looseness within these constraints may also help to spawn the development of creative technical solutions that are needed to contain the pandemic, as well as creating novel tools to help people feel connected. The cumulative evidence here suggests that very different strategies might be called for in varying cultural contexts in the fight against COVID-19.

Political polarization. One cultural barrier for coordinated action within countries is political polarization. Polarization among citizens comes in two varieties. 'Attitudinal polarization' concerns partisans taking extreme opposing issue positions, whereas 'affective polarization' refers to partisans disliking and distrusting those from the opposing party(ies)^{87,88}. Affective polarization has political consequences, such as decreasing trust⁸⁹, privileging partisan labels over policy information⁹⁰ and believing false information⁹¹, that can undermine social and economic relationships⁸⁸ and impair public health.

One issue with polarization during a pandemic is that it might lead different segments of the population to arrive at different conclusions about the threat in the situation and appropriate actions. Partisans may receive different news because individuals can self-select polarized news sources or partisan 'echo chambers'^{92,93} or can communicate in ways that are associated with less cross-partisan information sharing⁹⁴. But in-person political interactions can provide more opportunity for cross-partisan communication⁹⁵ (that produce a shared understanding). The decrease in in-person contact due to COVID-19 may reduce cross-partisan interactions and information sharing.

However, there are actionable steps that could reduce polarization. First, the pandemic not only highlights a common identity with individuals all facing the same risk, but could also foster a sense of shared fate. By highlighting an overarching identity, politicians, the media and opinion leaders could help reduce political division around the issue. Second, a growing body of work shows that misperceptions of the other side underlie polarization^{96,97}. Therefore, it is likely important to combat misinformation that could generate partisan motivated reasoning and inaccurate beliefs (see "Fake news and misinformation" below). Finally, leaders can highlight bipartisan support for COVID-19-related measures, when they exist, as such endorsements in other contexts have reduced polarization and led to less biased reasoning⁹⁸.

Science communication

The information environment around a pandemic underscores the importance of effective science communication. The COVID-19 pandemic has already seen a rise in conspiracy theories, fake news and misinformation⁹⁹. In this context, it is hard for the public to distinguish scientific evidence and facts from less reliable sources of information. In this section, we discuss the challenges associated with different forms of misinformation during a pandemic, as well as strategies for engaging in effective science communication and persuasion around public health.

Conspiracy theories. Conspiracy theories emerged shortly after the first news of COVID-19 and have continued to persist⁹⁹. Some concerned the origins of the SARS-CoV-2 virus, for example, that it was a bioweapon created by the Chinese to wage war on the US or vice versa¹⁰⁰. Others focused on prevention and cure, for instance, that conventional medical treatment should not be trusted and that people should use alternative remedies to ward off the virus¹⁰¹. It is not surprising that conspiracy theories have flourished at this time. Research suggests that people feel the need to explain large events

with proportionally large causes¹⁰² and are more likely to believe in conspiracy theories about events with serious consequences¹⁰³ and in times of crisis¹⁰⁴. This is likely because people are more drawn to conspiracy theories when important psychological needs are frustrated¹⁰⁵. Thus, conspiracy theories may gain more traction as COVID-19 spreads and more people isolate themselves¹⁰⁶.

These conspiracy theories can have harmful consequences. For example, belief in conspiracy theories has been linked to vaccine hesitancy¹⁰⁷, climate denial¹⁰⁸, extremist political views¹⁰⁹ and prejudice^{110,111}. COVID-19 conspiracy theories may be similarly problematic. For instance, people who believe that alternative remedies can help them fight off the virus may be less likely to follow health officials' advice and instead opt for less effective (at best) or lethal (at worst) alternatives. Conspiracy beliefs may also fuel hostility toward groups seen as responsible for the virus¹¹². Some evidence suggests that giving people factual information before exposure to conspiracy theories can reduce conspiracy theory beliefs¹¹³, and this strategy might work in efforts to combat conspiracy theories relevant to the current pandemic (see "Fake news and misinformation" below for similar findings). However, because some people tend to consume information within like-minded 'echo chambers', combating conspiracy theories remains a challenge¹¹⁴.

Fake news and misinformation. Fake news and misinformation about COVID-19 have proliferated widely on social media, with potentially dangerous consequences¹¹⁵. Emerging research is using social science to understand and counter the spread of fake news¹¹⁶⁻¹¹⁸. One approach is to debunk using fact-checking and correction¹¹⁹⁻¹²¹. Source expertise, co-partisanship, exposing denial, and corrections that provide causal explanations all tend to increase the effectiveness of countering misinformation¹²²⁻¹²⁴. However, fact-checking may not keep up with the vast amount of false information produced in times of crisis like a pandemic. Moreover, there is mixed research regarding whether corrections may actually increase belief in the original misinformation^{121,124-126} or in other misleading claims that fail to get corrected¹²⁷. Thus, other approaches beyond debunking are needed.

One 'prebunking' approach involves psychological inoculation^{128,129}. Inoculation follows the biomedical analogy: people are exposed to a severely weakened dose of a persuasive argument, strong enough to trigger the immune system but not so strong as to overwhelm it. A meta-analysis has found inoculation effective in protecting attitudes from persuasion¹³⁰. The fake news game *Bad News* is a real-world inoculation intervention (<https://www.getbadnews.com>) used by schools and governments that finds that pre-emptively exposing people to small doses of misinformation techniques (including scenarios about COVID-19) can reduce susceptibility to fake news^{131,132} and could be embedded directly on social media platforms¹³³.

Another preventative approach involves subtle prompts that nudge people to consider accuracy. Evidence suggests that deliberation is associated with¹³⁴⁻¹³⁶ and causes¹³⁷ reduced belief in false news headlines that circulated on social media. Platforms could nudge users to think about accuracy by, for example, periodically asking users to rate the accuracy of randomly selected posts. The crowdsourced accuracy ratings generated by this process may also be useful for identifying misinformation, as has been found for crowd ratings of source trustworthiness^{138,139}.

To effectively counter fake news about COVID-19 around the world, governments and social media companies must rigorously develop and test interventions. This includes identifying treatments that effectively reduce belief in misinformation, while not undermining belief in accurate information¹⁴⁰.

Persuasion. In the domain of science communication, scholars have explored a host of messaging approaches, including providing

information in evidence-based ways that increase understanding and action¹⁴¹. Decades of research has found that, whether recipients are motivated to think carefully or not¹⁴², sources perceived as credible are more persuasive¹⁴³. The credibility of sources stems from how trustworthy and expert they are perceived to be¹⁴⁴. Enlisting trusted voices has been shown to make public health messages more effective in changing behaviour during epidemics. During the West African Ebola crisis, for example, religious leaders across faiths in Sierra Leone advocated for practices such as handwashing and safe burials. The engagement of the faith-based sector was considered a turning point in the epidemic response¹⁴⁵. Therefore, finding credible sources for different audiences who are able to share public health messages might prove effective.

Once a credible source is identified, what message should be delivered? Several messaging approaches may be effective, including emphasizing the benefits to the recipient¹⁴⁶, focusing on protecting others (for example, 'wash your hands to protect your parents and grandparents'¹⁴⁷), aligning with the recipient's moral values¹⁴⁸, appealing to social consensus or scientific norms^{149–151} and/or highlighting social group approval^{152,153}. Which of these messages work best depends on the audience's motivations¹⁵⁴. Beyond finding effective messages for attitude change is the issue of inducing behavioural change. This occurs when people feel confident about their attitudes¹⁵⁵. Methods to increase certainty include helping people feel knowledgeable about their new attitude¹⁵⁶ and making them feel that their new attitude is the 'moral' one to have¹⁵⁷. It may therefore be useful to identify which messages work best on which populations not only to generate policy support but also to ensure individuals' actions needed to combat the spread of the virus.

Aligning individual and collective interests

The behaviour of individuals living in communities is regulated by moral norms and values^{158–162}. People who do what is 'right' are respected and publicly admired, while those who do what is 'wrong' are devalued and socially excluded¹⁶³. These mechanisms of social enforcement encourage people to embrace and internalize shared guidelines, making them motivated to do what is considered right while avoiding behaviours that seem wrong¹⁶⁴, and do not rely on legal agreements and formal sanctions¹⁶⁵. In this section, we consider how research on morality and cooperation can encourage pro-social behaviours by individuals and groups.

Zero-sum thinking. People often default to thinking that someone else's gain—especially someone from a competing group—necessitates a loss to themselves, and vice versa^{166,167}. Zero-sum thinking fits uneasily with the non-zero-sum nature of pandemic infection, where someone else's infection is a threat to oneself and everyone else¹⁶⁸. Zero-sum thinking means that while it might be psychologically compelling to hoard protective materials (sanitizer, masks, even vaccines) beyond what is necessary, doing so could be self-defeating. Given the importance of slowing infections, it may be helpful to make people aware that others' access to preventative measures is a benefit to oneself.

Whereas reducing infections across the population is non-zero-sum, the provision of scarce health care resources to the infected does have zero-sum elements. For example, when the number of patients needing ventilators exceeds capacity, health care providers are often forced to make life-for-life trade-offs. How well the policies enacted match the local norms can help determine how much support they receive. While some people are willing to sacrifice the elderly to save the young¹⁶⁹, there are cultural differences on this preference¹⁷⁰. Who is perceived to be making those decisions may also impact the public's and patients' trust. In experiments, people who make utilitarian judgments about matters of life and death are less trusted¹⁷¹. American's trust in medical doctors remains high¹⁷², and compared to public health officials, doctors

are less utilitarian in their ethical decision-making, opting instead for deontic 'do no harm' rules¹⁷³. As such, it may be best to have decisions behind life-for-life trade-offs perceived as systematic and coming from governmental agencies rather than from physicians themselves.

Moral decision-making. Moral decision-making during a pandemic involves uncertainty. It's not certain whether social interactions will infect others. People may be less willing to make sacrifices for others when the benefits are uncertain^{174,175}. For instance, in hypothetical scenarios about deciding whether to go to work while sick, American and British participants reported they would be less willing to stay home when it was uncertain they would infect a co-worker. However, when going to work risked infecting an elderly co-worker who would suffer a serious illness, participants reported they would be more willing to stay home¹⁷⁶. Thus, focusing on worst-case scenarios, even if they are uncertain, may encourage people to make sacrifices for others.

When people make moral decisions, they often consider how others would judge them for behaving selfishly^{177,178}. Harmful actions are judged more harshly than harmful inactions^{179,180}, and causing harm by deviating from the status quo is blamed more than harming by default^{181,182}. Therefore, reframing decisions to carry on with 'business as usual' during a pandemic as active decisions, rather than passive or default decisions, may make such behaviours less acceptable.

Cooperation within groups. Fighting a global pandemic requires large-scale cooperation. The problem is that, by definition, cooperation requires people to bear an individual cost to benefit other people¹⁸³. In particular, there is a conflict between short-term self-interest vs longer-term collective interest¹⁸⁴. Moreover, in this pandemic, there are several collectives (for example, family, community, national and international) which can make decisions to cooperate challenging. From an evolutionary perspective, extending self-interest to protect and promote the welfare of family members should be a small step, as it increases genetic fitness. Indeed, laboratory research has found that people prioritize local over global (or international) interests^{185,186}. One major question, then, is how to promote cooperation.

Several techniques, such as sanctioning defectors¹⁸⁷ or rewarding cooperators¹⁸⁸, tend to increase cooperative behaviour in laboratory experiments using economic games. Providing cues that make the morality of an action salient (such as having people read the Golden Rule before making a decision or asking them to report what they think is the morally right thing to do) have also been shown to increase cooperation^{189,190}. People are also more likely to cooperate when they believe that others are cooperating¹⁹¹. Accordingly, interventions based on observability and descriptive norms are highly effective at increasing cooperative behaviour in economic games as well as in the field¹⁹². This suggests that leaders and the media can promote cooperation by making these behaviours more observable.

Leadership. Crises like the COVID-19 pandemic create an opportunity for leadership across groups of varying levels: families, workplaces, local communities and nations. Leadership can coordinate individuals and help them avoid behaviours that are no longer considered socially responsible. In this section, we discuss the roles of trust and compliance with leaders, effective identity leadership and supporting group members.

Trust and compliance. During a pandemic, health officials often need to persuade the population to make a number of behaviour changes and follow health policies aimed at containment—e.g., honouring quarantine or reporting voluntarily for medical testing. By their nature and the scope of the population, such measures can

be difficult to enforce. Research from the West Africa Ebola crisis of 2014–2015 suggests that enlisting local voices to help build engagement and trust in health officials can increase the success of such public health measures. For instance, specialized Ebola treatment facilities that employed community liaisons and social mobilizers to raise awareness and resolve misconceptions were associated with increases in reporting Ebola cases¹⁹³. Correlational evidence from Liberia also suggests that explicit government efforts to reach out to the population, like door-to-door canvassing, are associated with compliance with crisis management policies like bans on gatherings¹⁹⁴.

Trust in institutions and governments also may play an important role. For example, trust in the Liberian government was correlated with decisions to abide by mandated social distancing policies¹⁹⁵ and using clinics for care during the Ebola outbreak¹⁹⁶. Trust was also related to decisions to adopt preventive measures such as Ebola vaccinations in the Democratic Republic of Congo¹⁹⁷. Conversely, a lack of trust in public health officials may lead to negative effects on utilization of health services¹⁹⁸. Reliable information and public health messages are needed from national leaders and central health officials. But local voices can amplify these messages and help build the trust that is needed to spur behavioural change.

Identity leadership. Experimental studies clarify what leaders can do to promote trust leading to cooperation. A priority for leaders is to create a sense of shared social identity amongst their followers¹⁹⁹. A large body of research suggests that people tend to prefer leaders who cultivate a sense that ‘we are all in this together’²⁰⁰. In part, such leadership gives people a sense of collective self-efficacy and hope²⁰¹. More importantly, though, it provides a psychological platform for group members to coordinate efforts to tackle stressors²⁰². Without leadership, there is a risk that people will avoid acts of citizenship and instead embrace a philosophy of ‘everyone for themselves’.

Leaders who are seen as prototypical of the group (‘one of us’) and as acting for the interest of the group as a whole (‘working for us’), rather than for themselves or for another group, tend to gain greater influence^{203,204}. Actions that divide the leader from followers or that suggest that the leader is not prepared to share the burdens of followers can be corrosive to their ability to shape followers’ behaviour²⁰⁵. For instance, leaders who threaten people with sanctions as a way to deter undesired behaviour may make people feel distrusted and paradoxically reduce their willingness to do as they are told²⁰⁶. Leaders and authorities who treat people with respect, and who communicate that they trust people to do as they are told, tend to be more successful in eliciting cooperation²⁰⁷.

Elevating the in-group without demeaning others. Building a strong sense of shared social identity can help coordinate efforts to manage threats²⁰² and foster in-group commitment and adherence to norms²⁰⁸. Leaders can do this, for instance, by being a source of ‘moral elevation’. Visibly displaying prosocial and selfless acts can prompt observers to also act with kindness and generosity themselves²⁰⁹. In this way, leaders can function as role models and motivate people to put their own values into action^{210,211}. Having respected politicians, celebrities and community leaders model exemplary behaviour and sacrifice could help promote prosocial behaviour and cooperation.

Excessive efforts to foster a sense of national unity by promoting the image of the nation as handling the situation exceptionally well can backfire, especially if there is no objective basis for this. An inflated belief in national greatness (i.e., ‘collective narcissism’²¹²) can be maladaptive in a number of ways. For instance, it is associated with a greater focus on defending the image of the country than on caring for its citizens^{213,214}. It is also correlated with seeing out-groups as a threat and blaming them for in-group misfortunes²¹⁵. To increase people’s willingness to take a pandemic seriously and

engage with other nations to defeat it, citizens and leaders may need to accept that their country is at risk, just like others, and find ways to share resources and expertise across national boundaries.

Stress and coping

Even for households free from the virus, the pandemic is likely to function as a major stressor, especially in terms of chronic anxiety and economic difficulties. Such effects may be exacerbated by self-isolation policies that can increase social isolation and relationship difficulties. In this section, we consider some strategies to mitigate the virus-linked threats to social connection, intimate relationships and stress.

Social isolation and connection. In the absence of a vaccine, one of the most vital strategies for slowing the pandemic is social distancing. However, distancing clashes with the deep-seated human instinct to connect with others²¹⁶. Social connection helps people regulate emotions, cope with stress and remain resilient during difficult times^{217–220}. By contrast, loneliness and social isolation worsen the burden of stress and often produce deleterious effects on mental, cardiovascular and immune health^{221,222}. Older adults, who are at the greatest risk of severe symptoms from COVID-19, are also highly susceptible to isolation²²³. Distancing threatens to aggravate feelings of loneliness and could produce negative long-term health consequences.

Scholars have identified strategies that could mitigate these outcomes. First, in psychological terms, loneliness is construed as the subjective state that one is not experiencing enough social connection, whereas isolation is an objective lack of social interactions²²⁴. This means one can be isolated but not lonely, or lonely in a crowd. Thus, the term ‘social distancing’ might imply that one needs to cut off meaningful interactions. A useful alternative term might be ‘physical distancing’, to help highlight the fact that social connection is possible even when people are physically separated.

Online interactions can also foster a sense of connection. Both receiving and giving support online can bolster psychological well-being²²⁵. However, we caution against enhanced passive use of social media, as research suggests that it may not contribute to one’s sense of social connection^{226,227}. Instead, technologies that are informationally rich, dyadic and temporally synchronous appear better suited to generating empathy and connection^{228,229}. Special attention should be placed on helping people who are less familiar with these technologies to learn how to take advantage of digital connections.

Intimate relationships. The social effects of the pandemic also extend to the inside of our homes, where many people find themselves in sudden forced proximity with their immediate family. People subject to quarantine or self-isolation are at risk for confusion and anger²³⁰, emotional tendencies that can be explosive when multiple household members simultaneously endure them for weeks or months on end. Indeed, some studies suggest that forced proximity is a risk factor for aggression^{231,232} and domestic violence²³³.

Even without forced proximity, stress, including economic stress²³⁴, is linked to relationship difficulties. It often changes the content of social interactions (for example, more focus on unpleasant logistics, less focus on emotional connection) and undermines the psychological resources, like empathy and patience, that make challenging interactions go smoothly²³⁵. A study of the effects of Hurricane Hugo in 1989, for example, revealed that harder-hit areas experienced a spike in the divorce rate²³⁶. The news is not all bad, however: the hurricane study also documented surging marriage and birth rates²³⁶.

Major stressors, it seems, alter the trajectories of our intimate relationships, but researchers are still unpacking when, why and for whom these effects are harmful vs beneficial. But one factor underlying success is for individuals to calibrate their expectations to the

circumstances, a process that will vary from couple to couple and from partner to partner²³⁷. The recalibration process involves both (i) lowering broad expectations that the course of true love in the time of COVID-19 will run smoothly while also (ii) sustaining high expectations in those domains where the relationship can deliver in these conditions.

Healthy mind-sets. In the face of a global pandemic, avoiding stress altogether is simply not an option. Fortuitously, the past twenty years of research on coping and stress suggest that it's not the type or amount of stress that determines its impact. Rather, mind-sets and situation appraisals about stress can alter its impact^{238,239}. For instance, some research finds these mind-sets can increase the possibility of 'stress-related growth', a phenomenon in which stressful experiences serve to increase physiological toughening^{240–242}, help reorganize our priorities and can help lead to deeper relationships and a greater appreciation for life²⁴³.

Preliminary research suggests that mind-sets about stress can be changed with short and targeted interventions. These interventions do not focus on viewing the stressor (such as the virus) as less of a threat²⁴⁴. Instead, they invite people to recognize that we tend to stress about things we care deeply about and that we can harness the stress response for positive gain. A number of studies found that inducing more adaptive mind-sets about stress could increase positive emotion, reduce negative health symptoms and boost physiological functioning under acute stress^{244,245}. Research is needed to see if adopting these mind-sets can help some people harness the stress during a pandemic for positive growth.

Conclusion

Over 100 years ago, *Science* magazine published a paper on lessons from the Spanish Flu pandemic²⁴⁶. The paper argued that three main factors stand in the way of prevention: (i) people do not appreciate the risks they run, (ii) it goes against human nature for people to shut themselves up in rigid isolation as a means of protecting others, and (iii) people often unconsciously act as a continuing danger to themselves and others. Our paper provides some insights from the past century of work on related issues in the social and behavioural sciences that may help public health officials mitigate the impact of the current pandemic. Specifically, we discussed research on threat perception, social context, science communication, aligning individual and collective interests, leadership, and stress and coping. These are a selection of relevant topics, but readers may also be interested in other relevant work, including on psychological reactance^{247,248}, collective emotions and social media^{249,250}, and the impact of economic deprivation and unemployment^{251,252}.

Urgent action is needed to mitigate the potentially devastating effects of COVID-19, action that can be supported by the behavioural and social sciences. However, many of the implications outlined here may also be relevant to future pandemics and public health crises. A recent report²⁵³ from the World Health Organization declared that "health communication is seen to have relevance for virtually every aspect of health and well-being, including disease prevention, health promotion and quality of life."

Received: 24 March 2020; Accepted: 9 April 2020;
Published online: 30 April 2020

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Author contributions

The corresponding authors (J.V.B. and R.W.) came up with the idea for the paper, invited authors to collaborate, and wrote and edited the manuscript. All other contributing authors (K.B., P.S.B., V.C., A.C., M.C., M.J.C., A.J.C., K.M.D., J.N.D., J.D., O.D., N.E., E.J.F., J.H.F., M.G., S.H., S.A.H., J.J., S.K., D.M., K.E.N., D.J.P., G.P., E.P., R.E.P., D.G.R., S.D.R., S.S., A.S., L.J.S., S.S.S., C.R.S., N.T., J.A.T., S.V.L., P.A.M.V.L., K.A.W., M.J.A.W., J.Z. and S.R.Z.) wrote and edited the paper and are listed in alphabetical order. We thank J. Rothschild for his help in inserting citations and organizing the list of biographical references.

Competing interests

The authors declare no competing interests.

Additional information

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Primary handling editor: Stavroula Kousta.

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