

**Antecedents and consequences of COVID-19 conspiracy beliefs:
A systematic review**

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Abstract

Rationale. Belief in COVID-19 conspiracy theories can have severe consequences; it is therefore crucial to understand this phenomenon.

Objective. The aim of this systematic review is to provide a comprehensive overview of the available research on COVID-19 conspiracy beliefs and to synthesise this research to make it widely accessible.

Method. We present a synthesis of COVID-19 conspiracy belief research from 85 international articles, identified and appraised through a systematic review, in line with contemporary protocols and guidelines for systematic reviews.

Results. We identify a number of significant antecedents of COVID-19 conspiracy beliefs (individual differences, personality traits, demographic variables, attitudes, thinking styles and biases, group identity, trust in authorities, and social media use) and their consequences (protective behaviours, self-centred and misguided behaviours such as hoarding and pseudoscientific health practices, vaccination intentions, psychological wellbeing, and other negative social consequences such as discrimination and violence), and the effect sizes of their relations with the conspiracy beliefs.

Conclusions. We conclude that understanding both the antecedents and consequences of conspiracy beliefs is highly important to tackle them, whether in the COVID-19 pandemic or future threats, such as that of climate change.

Key words: COVID-19, coronavirus, conspiracy beliefs, guideline adherence, vaccine hesitancy, systematic review

Introduction

Conspiracy theories about COVID-19 emerged almost immediately after the first reports of COVID-19 (Gogarty & Hagle, 2020), and continue to attract attention from people all over the world. Although the popularity of such theories should not be exaggerated (Sutton & Douglas, 2020), there is a substantial group of believers (Sanders, 2020; YouGov, 2020). Since SARS-CoV-2 is highly contagious and can cause serious health complications, governments all over the world rolled out safety guidelines aimed at curtailing the spread of the virus. However, adherence to these guidelines is negatively influenced by COVID-19 conspiracy beliefs (e.g., Allington et al., 2020; Freeman et al., 2020b), endangering the lives of many. In addition, COVID-19 conspiracy beliefs have been linked to other problematic attitudes, such as prejudice (He et al., 2020; Roberto et al., 2020) and reduced vaccination intentions (Bertin et al., 2020; Romer & Jamieson, 2020). It is, therefore, both highly important and timely to understand why COVID-19 conspiracy theories arise and gain supporters (antecedents), as well as what the range of potential effects of such beliefs is (consequences).

Conspiracy theories are “attempts to explain the ultimate causes of significant social and political events and circumstances with claims of secret plots by two or more powerful actors” (Douglas et al., 2019, 4) and “proposed explanation of events that cites as a main causal factor a small group of persons (the conspirators) acting in secret for their own benefit, against the common good” (Uscinski et al., 2016, 2). In the current article, we conduct a systematic review to identify the available empirical data on belief in COVID-19 conspiracy theories specifically. We identify *antecedents* of COVID-19 conspiracy beliefs such as individual differences (demographic variables, personality traits, coping styles), beliefs, biases and attitudes (epistemically suspect beliefs, thinking styles and biases, and attitudes towards science), and social factors (group identities, trust in authorities, and social media use) and their *consequences*, such as protective behaviours (safeguarding behaviours and self-centred behaviours) and health and social consequences (vaccination intentions, psychological wellbeing, and other negative social consequences such as discrimination and violence), see Figure 1.

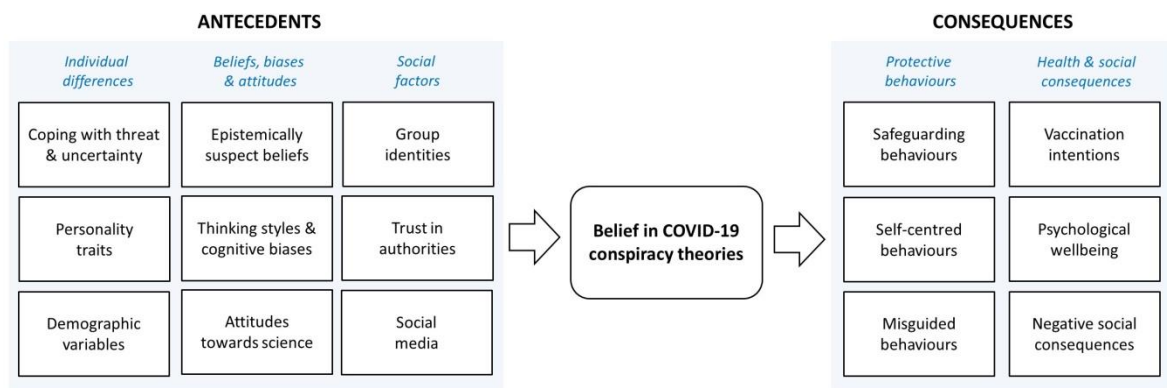


Figure 1. Overview of the paper.

The aim of our systematic review is to provide a comprehensive overview of the currently available research on COVID-19 conspiracy beliefs by identifying both the antecedents and consequences of COVID-19 conspiracy beliefs, and to synthesise this research to make it widely available and comprehensible. This effort serves to support both ongoing and future research and applications.

Methods

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol (Moher et al., 2009) to conduct and report the systematic review, and checked it with the AMSTAR 2 Checklist (Shea et al., 2017) to examine any potentially remaining issues with the systematic review following the PRISMA protocol (Johnson & Hennessy, 2019); please see Supplementary Materials SM.1 for our PRISMA and AMSTAR 2 statements. We choose to do a systematic review rather than a meta-analysis given the wide variety of research designs, measures, and outcomes within the conspiracy belief literature, and since we did not want to focus on a singular aspect of COVID-19 conspiracy beliefs, but instead present an accessible overview of the possible antecedents and consequences.

We ran a database search to inform this review in October 2020 and repeated the search in March 2021; the results of these searches have been combined and the final set of publications is reported on here (see Figure 2). We searched Web of Science (incl. MEDLINE), Scopus, and PsycINFO databases for articles on COVID-19 conspiracy beliefs. Our search strategy included the words ‘COVID* (-19)’ or ‘corona*(virus)’ or ‘SARS-CoV-2’ and ‘conspir*(acy)’. Our strategy was to cast the net wide, and to include all COVID-19 research papers mentioning conspiracy beliefs. After removing duplicates, 142 records were identified. All authors moreover conducted their own searches for additional papers, and to avoid publication bias, we also allowed for preprints, and searched the online preprint database *PsyArXiv* (<https://psyarxiv.com/>)(listed under ‘Additional records identified through other sources’, Figure2). Finally, Google Scholar alerts were enabled to ensure inclusion of accepted articles and articles in preprint (Goreis & Voracek, 2019).

The records were screened (title and abstract) by the first author for the following three eligibility criteria: (1) The article must contain primary, empirical data; (2) The article must assess COVID-19 conspiracy beliefs, or general conspiracy belief/thinking in relation to specific COVID-19 phenomena, such as guideline adherence; (3) The article must be written in English, to ensure that all authors would be able to accurately assess the article. Next, full-text articles were assessed for eligibility for this review in duplicate - by the first author and authors of each subsection (see Supplementary Materials Table SM.2 for an overview of the subsection authors). The subsections were determined prior to the database searches, on the basis of the expertise of the author team. The

final selection consisted of eighty-five articles. For characteristics of the studies (e.g., countries included, types of samples), see Supplementary Materials SM.3. These articles were critically evaluated in an assessment of whether the conclusions made in each article were appropriate given the article's (i) sample, (ii) research design and methods, (iii) conspiracy belief measures, (iv) analyses (Higgins et al., 2019), and were provided with an assessment of low, medium, or high risk of bias, see Table SM.3 and Table SM.4 in Supplementary Materials.

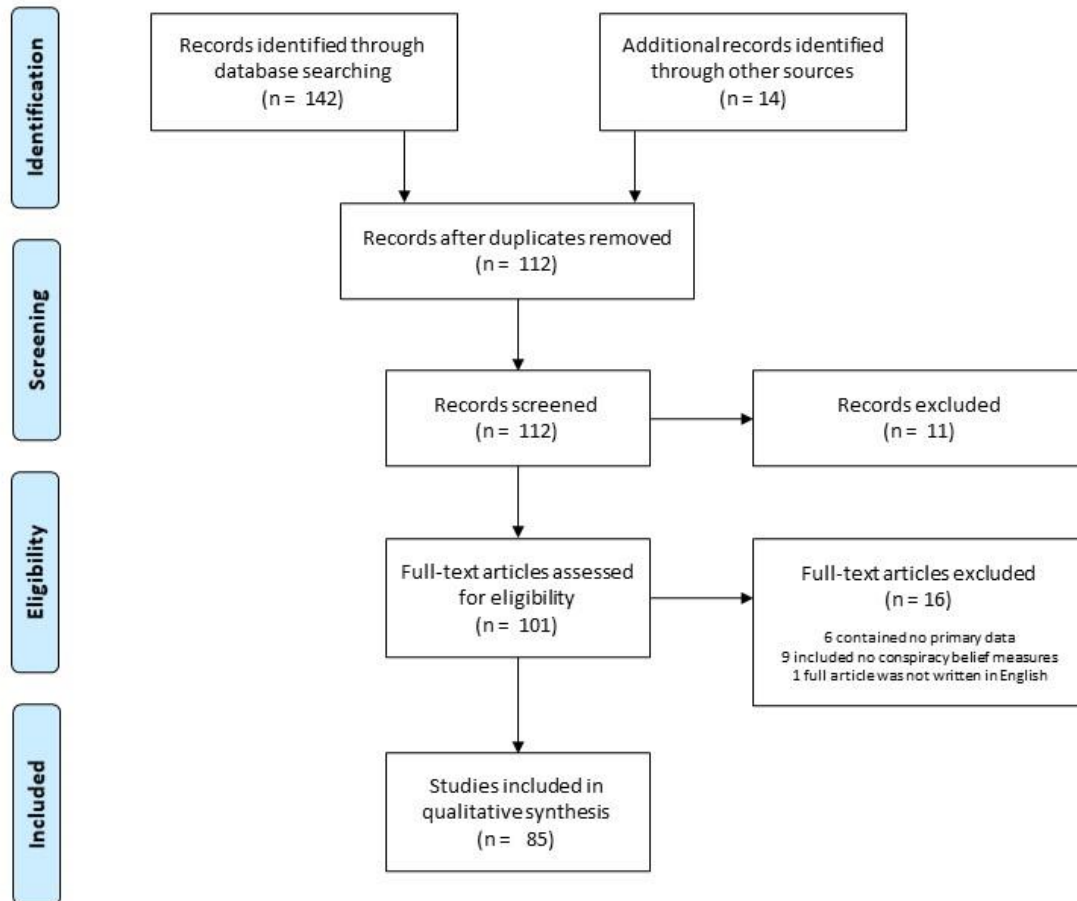


Figure 2. PRISMA flowchart of the systematic review procedure with screening, exclusion, and inclusion criteria

Results

The 85 articles contained 133 samples (including separate country samples, multiple studies within one article, and multiple waves in longitudinal studies), with 56 articles (42.1%) using one sample in their analysis. Of the studies that we reviewed, the majority collected data in March-May 2020

(76.8%), see Table SM.2. Most studies recruited adults from the general public, predominantly through convenience sampling (though paid and representative sampling was used often as well), and used a cross-sectional design. These participants were mostly from North America and Europe, more specifically the United States ($n=30$, 33.0%) and the United Kingdom ($n=14$, 15.4%), followed by multinational samples ($n=14$, 15.4%), Serbia and Poland ($n=5$, 5.5% each), Slovakia and Romania ($n=4$, 4.4% each), Austria and France ($n=3$, 3.3%), Croatia and Jordan ($n=2$, 2.2% each), and Turkey and Russia ($n=1$, 1.1% each). Sample size varied considerably, but was typically over 200 participants per sample. The average age of participants was 36.8 years ($SD = 7.8$), and the range of average age was 19.5-52.5 years. Notably, the majority of studies had a larger proportion of female than male participants ($M = 58.3\%$, $SD = 12.2\%$, range 30.8-87.3%). While we do not want to speculate why this might have happened here, this may have consequences for the generalisability of all the results, given gender differences in conspiracy beliefs.

Table 1

Characteristics of the samples of the 85 studies included in the review

Characteristic	Number of samples	% of total samples
<i>Time study was conducted</i>		
March 2020	25	20.0%
April 2020	49	39.2%
May 2020	22	17.6%
June 2020	5	4.0%
July 2020	9	7.2%
August 2020	1	0.8%
September 2020	1	0.8%
November 2020	3	2.4%
December 2020	5	4.0%
January 2021	1	3.2%
Not reported	4	3.2%
<i>Continent of study samples</i>		
Europe	66	54.1%
North America	34	27.9%
South America	4	3.3%
Oceania	2	1.6%
Africa	0	0.0%
Asia	2	1.6%

Middle East	4	3.3%
Multinational	9	7.4%
Unknown	1	0.8%
<i>Study sample size</i>		
0-200†	5	3.8%
200-400	36	27.1%
400-600	20	15.0%
600-800	20	15.0%
800-1000	11	8.3%
1000-2000	24	18.0%
2000+	17	12.8%
<i>Sample participants</i>		
Adults	98	89.9%
Students	10	9.2%
Essential workers (e.g., health workers)	1	0.9%
<i>Participant recruitment method</i>		
Convenience sample	62	57.1%
Nationally representative sample	26	23.2%
Paid recruitment (e.g., MTurk, Prolific)	21	18.8%
<i>Study design</i>		
Cross-sectional	98	88.9%
Longitudinal	9	6.7%
Experimental	4	4.4%

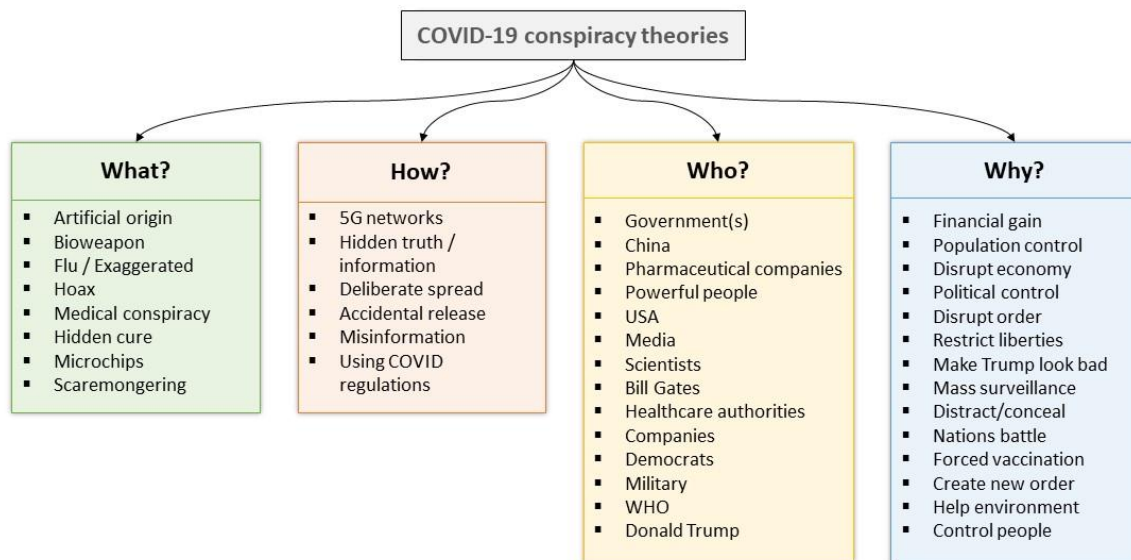
Note. †Smallest sample size n=120 (multinational). Number of samples may differ between categories due to the inclusion of separate country samples, study samples, and multiple longitudinal samples. The information this table summarises can be found in Table SM.3.

In line with previous conspiracy belief research, six studies used the 15-item Generic Conspiracist Beliefs scale (GCB; Brotherton et al., 2013), also called ‘conspiracy ideation’, comprising five dimensions (government malfeasance, malevolent global conspiracies, extra-terrestrial cover-up, personal wellbeing, and control of information), six studies employed the 5-item Conspiracy Mentality Questionnaire (CMQ; Bruder et al., 2013), and one study used seven items of another conspiracy mentality scale (Stojanov & Halberstadt, 2019) and five items for belief in specific conspiracy theories (van Prooijen et al., 2018), and one other study used thirteen items for belief in other conspiracy theories (adapted from Douglas et al., 2016).

The majority of COVID-19 conspiracy belief studies, however, included specific COVID-19 conspiracy theory items, often newly designed for each study (see Supplementary Table SM.3, which

lists all available individual items of the studies). In Figure 3 we have listed the most frequently *tested* theories¹ (see Supplementary Materials Table SM.5 for an overview of all categories with example items and percentages of occurrence, and see Supplementary Materials Table SM.6 all categorised items used in the articles in this systematic review, in total representing 718 conspiracy ideas). As is also clear from the example items, the items can often fit in multiple categories. The tested theories deal with a complex and social or political event by explaining *what* is happening (e.g., the virus is a bioweapon, vaccines contain microchips) and *how* it is happening (e.g., 5G allows the virus to spread, the truth is hidden), and suggesting that there are powerful actors at play (*who* is involved, such as Bill Gates and Big Pharma) and what the unclear causes might be (*why* is this happening – e.g., to control the population, for financial gain). Of all tested items, 30.9% contained a *what* element, 14.3% contained a *how* element, 24.5% contained a *who* element, and 30.2% contained a *why* element.

These categories are not mutually exclusive, and COVID-19 conspiracy belief was generally measured in the studies of this review with a composite average of items reflecting several theories at once (with Cronbach's α ranging from 0.66-0.98, $M = 0.84$, $SD = 0.08$), meaning that only occasionally inferences can be made about the effects of individual theories. The items were most often rated on a 5-point (31.7%) or 7-point (24.8%) Likert scale, typically measuring agreement (52.5%), followed by measurements of truth (17.1%), naturalness versus artificiality (8.2%) and believability (5.1%).



¹ Note that this does not reflect which conspiracy theories endorsed most often, or occur most frequently, but rather which conspiracy theories have been tested the most often.

Figure 3. Overview of the (non-mutually exclusive) conspiracy theories categories (What, How, Who, Why) and subcategories (ordered in frequency of occurrence) of the items used in the studies in this review.

Antecedents

Individual Differences

People differ in the degree to which they endorse conspiracy theories (Darwin et al., 2011), and some of this variation may be attributable to characteristics of the individual (i.e., individual differences). For COVID-19 conspiracy beliefs, research has examined how differences in demographic variables, personality traits, and reactions to threat and uncertainty affect the tendency to believe in these theories, through influencing both content and context.

Coping with Uncertainty and Threat

The COVID-19 crisis is marked by many uncertainties about health, the economy, and potential treatments (Cipolletta & Ortu, 2020; Freckelton Qc, 2020; Jutzi et al., 2020), which can lead individuals to develop or adopt narratives, including conspiracy theories, to make sense of these events (Wagner-Egger et al., 2011), thus satisfying epistemic needs (i.e., needs for knowledge and lack of uncertainty). Indeed, higher levels of uncertainty (Miller, 2020a, b) as well as intolerance or avoidance of uncertainty have been related to higher level of COVID-19 conspiracy beliefs (Alper et al., 2020; Larsen et al., 2020) and conspiracy mentality (Farias & Pilati, 2021; Maftai & Holman, 2020).

However, the threat of COVID-19 does not just involve an epistemic need violation – a lack of certainties – but also existential need violations, such as a lack of autonomy and agency (Jutzi et al., 2020). COVID-19 conspiracy belief was associated with lack of personal control in samples from the United States and United Kingdom (Biddlestone et al., 2020), Poland (Oleksy et al., 2020), South Korea (Kim & Kim, 2021), and Slovakia (Šrol et al., 2021a; Šrol et al., 2021b). Threat perception was a predictor of COVID-19 conspiracy beliefs (Heiss et al., 2021) and experimentally manipulating threat salience of COVID-19 led to increased feelings of fear and anxiety, which in turn was associated with belief in conspiracy theories (Jutzi et al., 2020). COVID-19 conspiracy beliefs have also been associated with greater anxiety more broadly (Hartman et al., 2021; Kim & Kim, 2021; Radnitz & Hsiao, 2020; Sallam et al., 2020a; Sallam et al., 2020b; Šrol et al., 2021a; Šrol et al., 2021b). Risk perception, including both infection-related risks and consequence-related anxiety, was a consistent predictor of COVID-19 conspiracy beliefs in a South-Korean (Kim & Kim, 2021) and multinational sample (Pizarro et al., 2020). However, risk perception, like anxiety, is not only a predictor and can also be a consequence or correlate of COVID-19 conspiracy beliefs, something which may be disentangled in further non-cross-sectional research.

Personality Traits

A person's tendency to believe in conspiracy theories may also be driven, in part, by their personality traits (Bowes et al., 2020; March & Springer, 2019). People scoring high on the Dark Tetrad traits (e.g., Machiavellianism, narcissism, psychopathy, and sadism; Chabrol et al., 2009) are more likely to endorse COVID-19 conspiracy theories (Gligorić et al., 2021; Hughes & Machan, 2021; Kay, 2020, 2021b; Malesza, 2021). This may be the result of a tendency of high-scorers to distrust others and entertain odd beliefs and delusions (e.g., believing that other people are able to read one's mind) (Kay, 2021a, b; Meuer & Imhoff, 2021). Indeed, lower interpersonal trust was associated with conspiracy belief (De Coninck et al., 2021) among participants from Germany, New Zealand, and Portugal (van Mulukom, 2020), and Serbia, but not participants from 15 Latin American countries (Jovančević & Milićević, 2020). Moreover, delusion-proneness was associated with believing in a variety of COVID-19 conspiracy theories (Larsen et al., 2020), and disintegration—a disposition of psychotic-like behaviours and experiences—appears to play a role in determining whether a person will engage in pseudoscientific practices related to COVID-19 (e.g., consuming colloidal silver) (Lazarevic et al., 2020).

There is also substantial evidence that specific aspects of the Dark Tetrad traits are associated with conspiracist ideation. Machiavellian individuals—who are manipulative and cynical—seem to endorse conspiracy theories because they are attracted to the thought of taking part in a conspiracy themselves (Douglas & Sutton, 2011). Narcissistic individuals, on the other hand, appear to be drawn to these theories because they are excessively preoccupied with the opinions others hold about them (Cichocka et al., 2016a; Kay, 2021b). This excessive preoccupation is believed to breed mistrust and paranoia, which has, in turn, also been associated with believing in COVID-19 conspiracy theories (Jolley & Paterson, 2020; Kuhn et al., 2021; Larsen et al., 2020).

Impulsivity, which has traditionally been considered a key feature of psychopathy (Hare, 1999), has also been tied to believing that COVID-19 was spread intentionally (Alper et al., 2020). Impulsivity and the tendency to take risks may also help explain why, despite being more prone to believe in COVID-19 conspiracy theories, those with dark personalities are less likely to engage in behaviours intended to limit one's exposure to COVID-19 (Nowak et al., 2020). Impulsivity may also be associated with a hasty reasoning process (e.g., jumping to conclusions and liberal acceptance bias), associated with increased conspiracy beliefs (Kuhn et al., 2021). Conspiracy theories are characterised by simplistic views, which may be rejected through flexible and critical thinking and questioning one's own ideas, an attitude captured by 'open-minded thinking' (Swami et al., 2014). People with higher levels of open-minded thinking are less likely to believe in COVID-19 conspiracy theories (Erceg et al., 2020; Stoica & Umbreş, 2020) and are less likely to put their faith in misguided treatments (Erceg et al., 2020).

Demographic Variables

More broad individual differences, such as socio-demographic factors including age, gender, ethnicity, and income and education levels, have also been found to be related to the endorsement of COVID-19 conspiracy beliefs; however, there are conflicting results. While younger people tend to give more credence to COVID-19 conspiracy theories in a number of countries, including Cyprus, Greece, Poland, England, Germany, Switzerland, and the United States (Constantinou et al., 2020; De Coninck et al., 2021; Duplaga, 2020; Earnshaw et al., 2020; Freeman et al., 2020b; Kuhn et al., 2021; Pizarro et al., 2020; Romer & Jamieson, 2020; Uscinski et al., 2020), older people do so in samples from Brazil and Portugal (van Mulukom, 2020) and the United Kingdom (Juanchich et al., 2021). Results are similarly conflicting but skewed for gender: Women from multinational samples (Pizarro et al., 2020; van Mulukom, 2020), Turkey (Alper et al., 2020), Jordan (Sallam et al., 2020b), Kuwait, Saudi Arabia (Sallam et al., 2021; Sallam et al., 2020a) as well as from Greek student samples (Patsali et al., 2020) were more likely to adopt such beliefs. In one large sample from the United States (Cassese et al., 2020), men were more likely to endorse COVID-19 conspiracy theories, which was linked to their higher levels of learned helplessness and general conspiratorial thinking, whereas no gender differences in COVID-19-related conspiracy beliefs were found in other samples from the United Kingdom (Freeman et al., 2020b), Germany and Switzerland (Kuhn et al., 2021), and the United States (Earnshaw et al., 2020). These conflicting findings suggest the effect of age and gender² on COVID-19 conspiracy beliefs may be part of a complex interplay of psychological and social factors rather than individual predictors (van Prooijen, 2017), though different measures of conspiracy beliefs may also play a role (Goreis & Voracek, 2019). Indeed, two of the three studies which showed no gender differences are also the studies which averaged scores of a relatively large number of items (n=48) for a composite score of conspiracy belief, whereas studies comparing scores of individual items demonstrated varying differences between male and female gender (Patsali et al., 2020).

More consistently, people who are white have been found to endorse COVID-19 conspiracy beliefs less often than other ethnic groups in the United Kingdom (Freeman et al., 2020b) and in the United States (Romer & Jamieson, 2020), where a higher percentage of Black people endorse them than other ethnicities do (Earnshaw et al., 2020). This may be associated with the lower levels of trust and higher levels of experienced threat in these individuals. Similarly, individuals with lower (vs. higher) income tend to hold stronger beliefs in COVID-19 conspiracy theories (Constantinou et al., 2020; Hornik et al., 2021; Romer & Jamieson, 2020; Sallam et al., 2020a; Sallam et al., 2020b; van Mulukom, 2020), as do individuals with lower (vs. higher) levels of education (Achimescu et al., 2021; Constantinou et al., 2020; De Coninck et al., 2021; Duplaga, 2020; Georgiou et al., 2020; Hartman et al., 2021; Hornik et al., 2021; Kuhn et al., 2021; Pizarro et al., 2020; Romer & Jamieson, 2020; Sallam et al., 2021; Sallam et al., 2020b; van Mulukom, 2020), which may be associated with lower levels of information. This may, however, depend on the type of conspiracy theory. When

² Interactions between gender and age, education or income may be illuminating here.

comparing broad (e.g., “The virus is a hoax”) to narrow (e.g., “The elite have created the virus in order to establish a one-world government”) COVID-19 conspiracy beliefs, only broad beliefs were associated with lower education levels in an English sample (Freeman et al., 2020b).

Beliefs, Biases and Attitudes

Unwarranted or epistemically suspect beliefs, including conspiracy beliefs, have previously been referred to as ‘contaminated mindware’ (Stanovich et al., 2008). These beliefs – which constitute low levels of correct, scientific information – have repeatedly been shown to be strongly interrelated (Čavojová et al., 2020b; Lobato et al., 2014), and to share common predictors, such as ontological confusions (Lobato et al., 2014; Rizeq et al., 2020) – a specific kind of category mistake whereby the properties of one core ontological knowledge domain (physical, biological, or psychological) are inappropriately used to understand a phenomena from other core knowledge domain (Lindeman & Aarnio, 2007), the inhibition of analytical reasoning (Stanovich, 2009), preference of intuitive over analytic thought (Pennycook et al., 2015), and lower levels of scientific reasoning (Čavojová et al., 2020b). In this section, these beliefs, reasoning processes, and attitudes – antecedents that primarily influence which informational content is taken on – will be reviewed with regard to belief in COVID-19 conspiracy theories.

Epistemically suspect Beliefs

Epistemically suspect beliefs are a category of beliefs which are not in line with the state of currently accumulated empirical knowledge (Lobato et al., 2014; Pennycook et al., 2015). The three most commonly recognized types of epistemically suspect beliefs are paranormal, conspiracy, and pseudoscientific beliefs (Lobato et al., 2014). People who believe COVID-19 conspiracy theories are also more likely to endorse: other and even contradictory COVID-19 conspiracy beliefs (Miller, 2020a), popular generic conspiracy theories and motives (Freeman et al., 2020b; Georgiou et al., 2020), claims about the effectiveness of pseudoscientific remedies for COVID-19 (Fuhrer & Cova, 2020; Pavela Banai et al., 2020) and remedies for other serious illnesses (Čavojová et al., 2020a), pseudoscientific attitudes toward vaccination (Bertin et al., 2020), and even paranormal phenomena, such as belief in ghosts, the magical powers of the moon or the Bermuda triangle (Šrol et al., 2021b). Spirituality in the form of eco-awareness (e.g., belief in a higher power or universal intelligence and meditating to gain access to one’s “inner spirit”) has predicted COVID-19 conspiracy beliefs (Gligorić et al., 2021). Finally, individuals who infer relationships between unrelated phenomena (such as those measured by illusory correlations and base-rate neglect) were more likely to believe in COVID-19 conspiracy theories (Teovanovic et al., 2020).

Thinking Styles and cognitive Biases

Several cognitive biases and styles, usually those that are in conflict with more analytical, elaborative thinking, are argued to foster conspiracy beliefs (Brotherton & French, 2014; Douglas et al., 2016; Swami et al., 2014). Lower performance on the Cognitive Reflection Test (CRT; Frederick, 2005), a typical measure of analytical thinking, was related to endorsing more COVID-19 conspiracy beliefs in U.S. (Stanley et al., 2020), Turkish (Alper et al., 2020), Iranian (Sadeghiyeh et al., 2020), Serbian (Teovanovic et al., 2020), Slovak (Čavojová et al., 2020a), Croatian (Erceg et al., 2020), and Romanian (Stoica & Umbreş, 2020) samples (r -values ranging from $-.18$ to $-.46$). Similarly, ‘cognitive sophistication’, which is a composite of cognitive reflection, numeracy, science literacy, and bullshit receptivity, was found to be negatively related to COVID-19 misperceptions in Canada, the United Kingdom, and the U.S. (Pennycook et al., 2020a).

In addition to performance on the CRT, self-report measures on preference for intuitive versus analytical thinking also showed that more intuitive and less analytical thinking styles were related to higher levels of COVID-19 conspiracy beliefs (Alper et al., 2020; Erceg et al., 2020; Fuhrer & Cova, 2020; Gligorić et al., 2021; Kim & Kim, 2021; Lazarevic et al., 2020). Individuals who tend to rely on their intuitions and who had lower basic scientific knowledge were moreover less able to distinguish between true and false information regarding COVID-19 and more likely to share misinformation (Pennycook et al., 2020b). This may be due to hasty reasoning processes (Pennycook & Rand, 2019): endorsing COVID-19 conspiracy theories has been associated with a greater jumping-to-conclusions bias (collecting less information before making a decision), liberal acceptance bias (make judgments with low-to-moderate certainty), and bias against disconfirmatory evidence (adhering more to an already held specific belief, even if this turns out to be invalid) compared to lower endorsement of the theories (Kuhn et al., 2021). Indeed, misinformation research has similarly demonstrated that reminding individuals to pay more attention to the claims’ accuracy resulted in them being less likely to share misinformation about COVID-19 (Pennycook et al., 2020b).

Attitudes towards Science

Several of the more prominent COVID-19 conspiracy theories rely on the rejection of genuine scientific research (from sources such as scientific experts and other authorities), such as the research indicating a natural origin of the virus (Andersen et al., 2020). Higher interest in science has been related to having less unfounded beliefs and greater knowledge about COVID-19 (Bruder & Kunert, 2021; Constantinou et al., 2020; Erceg et al., 2020), whereas belief in COVID-19 conspiracy theories have been associated with lower scientific reasoning, and, in turn, less correct knowledge and more false beliefs about COVID-19 (Čavojová et al., 2020a; Sallam et al., 2020a). Distrust in science is associated with populist attitudes that are closely related to conspiracy beliefs about COVID-19, independent of political ideology (Eberl et al., 2021). Moreover, the effect of conspiracy ideation on non-compliance with health guidelines is mediated by trust in science (Plohl & Musil, 2020), which is

one of the strongest predictors of compliance with health guidelines (Dohle et al., 2020; Koetke et al., 2020; Plohl & Musil, 2020) .

Similarly, belief in the artificial creation theory and other COVID-19 conspiracy theories is negatively correlated with self-reported knowledge about COVID-19 in multinational (van Mulukom, 2020) and South Korean (Kim & Kim, 2021) samples. This may be associated with denialism: a predisposition to reject information from experts and official accounts of major events, and a major predictor of COVID-19 conspiracy beliefs (Uscinski et al., 2020). This suggestion is demonstrated in Kim and Kim (2021) who find that the belief that coronavirus-related information provided by the government is objective and scientifically-based predicted reduced conspiracy theory endorsement. On the other hand, belief in conspiracy narratives is not necessarily mutually exclusive from belief in narratives in line with scientific consensus; they can co-exist (Agley & Xiao, 2021). All the same, the degree to which people accepted additional, alternative explanations of the origin of the virus (alternative to the consensus view) was predicted by low levels of trust in science and scientists (Agley & Xiao, 2021). Similarly, general scepticism about science is correlated with a greater willingness to spread various kinds of misinformation about COVID-19 (Roozenbeek et al., 2020), including conspiracy claims (Lobato et al., 2020). In countries with less belief in science (indexed by prevalence of climate sceptics) adherence to physical distancing measures is also lower (Brzezinski et al., 2020).

Social Factors

While conspiracy theory beliefs may be broadly categorised as epistemically suspect beliefs or misinformation, they are distinct as they importantly also involve a social or intergroup dimension (Cichocka et al., 2016b; van Prooijen & van Lange, 2014). Conspiracy beliefs postulate that there is a(n) (out)group, often small and hidden (and therefore uncertain) but powerful and nefarious, which is in some way threatening the individual or their ingroup (van Prooijen & van Lange, 2014). In this section, we put forward research showing how social contexts –antecedents that primarily influence learning context – affect endorsement of COVID-19 conspiracy theories.

Group Identities

Belonging to a group means having a group of individuals, an ‘ingroup’, who you can trust to fall back onto, for protection or for information. This also means however that one can feel threatened, not as an individual, but as a group, in particular by other groups, which are demarcated as ‘outgroups’ (a group with which one does not identify). This means that COVID-19 conspiracy beliefs may be used to justify and defend the socio-political status of one’s ingroup (Imhoff & Bruder, 2014), buffering any criticism in the process. This may explain why higher levels of collective narcissism are associated with belief in COVID-19 conspiracy theories (Hughes & Machan, 2021; Sternisko et al., 2020), as the latter may be a way to protect grandiose national identities that are threatened by the

pandemic, superordinate levels of identity which provide support and guidance during a time of uncertainty and threat (Abrams et al., 2021; Oleksy et al., 2020). For a more nuanced understanding, it may be helpful to distinguish the effects of ‘downward’ and ‘upward’ conspiracy theories (Nera et al., 2021), which differ in which groups they target: upward conspiracy theories target relatively powerful groups, whereas downward theories target relatively powerless groups. In Polish samples, for example, belief in COVID-19 conspiracy theories that were related to targeting outgroups (i.e., a downward conspiracy theory) generally was linked to support for xenophobic policies, while belief in government-related COVID-19 conspiracy theories (i.e., an upward conspiracy theory) was not (Oleksy et al., 2020).

This means that COVID-19 conspiracy beliefs are therefore also expected in groups that are not necessarily threatened on a socioeconomic level, but who might feel threatened on a different level, such as national or political identity. For example, in the United States, conservative individuals tend to hold stronger beliefs in COVID-19 conspiracy theories than liberals (Calvillo et al., 2020; Havey, 2020; Miller, 2020b; Romer & Jamieson, 2020; Uscinski et al., 2020), perceive less personal vulnerability and rate the virus as less severe (Calvillo et al., 2020), potentially as reaction to criticism concerning handling of the pandemic by the Republican president at the time (Miller, 2020b). Conservatives are also less accurate than liberals at discerning between real and fake headlines (Calvillo et al., 2020) and are more willing to spread conspiracy-themed misinformation online (Lobato et al., 2020). In South Korea however no effect of conservative or progressive ideology was found (Kim & Kim, 2021).

In a Turkish sample, those who subscribed to right-wing ideologies were more likely to believe in COVID-19 conspiracy theories (Alper et al., 2020), and in a Brazilian sample, these ideologies were linked to believing in (generic) conspiracy theories about personal wellbeing and the control of information (but, interestingly, not government malfeasance) (Farias & Pilati, 2021). Both right-wing authoritarianism and social dominance orientation (a measure of preference for hierarchical social system) predicted belief in population control and bioweapon theories (but not conspiracy theories around hidden information, government corruption, or the pharmaceutical industry) in a multinational sample (Pizarro et al., 2020) and the Wuhan laboratory conspiracy theory in a British sample (Hartman et al., 2021), though right-wing authoritarianism did not predict the 5G conspiracy theory. In a Romanian sample, far-right political views were *negatively* related to belief in COVID-19 conspiracy theories (Stoica & Umbreş, 2020), which might be due to the specific situation in Romania where being on the left of the political spectrum is related to religiosity and being less progressive. Moreover, in another Romanian sample, holding pro-Russian as well as anti-EU, U.S. and NATO attitudes was associated with stronger COVID-19 conspiracy beliefs (Achimescu et al., 2021).

There also seems to be a connection between religiosity and COVID-19 conspiracy belief in some countries: In a sample comprising mostly Americans, political conservatism, religious

orthodoxy, and conspiracist ideation were associated with less trust in science, which explained their unwillingness to adhere to safeguarding behaviours (Plohl & Musil, 2020), and Republican partisanship, conservative ideology, and religiosity were each significant predictors of COVID-19 conspiracy beliefs in another United States sample (Uscinski et al., 2020). Religiosity predicted COVID-19 conspiracy belief in Turkey (Alper et al., 2020), and in a Polish sample, an increase in religious commitment during the pandemic was associated with increased conspiracy beliefs (in particular in overpopulation and US-China economic war theories) and possession of incorrect or less knowledge about COVID-19 (Boguszewski et al., 2020). In a South Korean sample, religiosity predicted COVID-19 conspiracy beliefs, but being a Christian was associated with reduced belief, with no effect of the other listed religious affiliations (Kim & Kim, 2021), possibly reflecting that a more extreme commitment to belief is associated with greater conspiracy belief.

Trust in Authorities

Conspiracy beliefs frequently call into question the very institutions which can provide accurate information (Connolly et al., 2019; Rutjens et al., 2021), removing or replacing some of the (authoritative) sources of information people generally rely on. Generic beliefs in conspiracy theories (during the COVID-19 pandemic) have, for example, been associated with distrust in the German government, health institutions and healthcare system (Bruder & Kunert, 2021). Believing specific COVID-19 conspiracy theories was associated with doubting or denying technical claims about COVID-19 in Germany (Rothmund et al., 2020) and with distrust in scientists and health organisations in multinational samples (De Coninck et al., 2021; van Mulukom, 2020). Trust in science predicted adherence to guidelines in Germany (Dohle et al., 2020) and in a large international survey (n=23,733) with representative samples from 23 countries (Han et al., 2021). It also mediated the negative effect of general conspiracy ideation on adherence to guidelines (Plohl & Musil, 2020). However, while trust in science and conspiracy belief seem irreconcilable, both trust in scientists and belief that COVID-19 was artificially created predicted compliance to COVID-19 guidelines (van Mulukom, 2020): potentially due to a suspicion that the artificially created virus might be used against oneself. Obtaining information from medical doctors and scientific journals was associated with fewer COVID-19 conspiracy beliefs in Jordan (Sallam et al., 2020b).

Oftentimes, scientific information is not directly transmitted from scientists, but relayed by governments or national health institutions, rendering trust in these institutions critical. Lack of trust in the government and politicians was associated with COVID-19 conspiracy beliefs in a multinational (De Coninck et al., 2021) and South Korean sample (Kim & Kim, 2021). Distrust in the government, the military, doctors, scientists, the World Health Organization (WHO), the United Nations, and the European Union (EU) were associated with belief in COVID-19 conspiracy theories in England (Freeman et al., 2020b) and in part in Romania (Achimescu et al., 2021). Instagram posts with the conspiracy hashtags #hoax and #pandemic were often co-presented with narratives

containing distrust in the government and other authorities (E. K. Quinn et al., 2021). Distrust in government officials further mediated the relationship of (political) COVID-19 and generic conspiracy beliefs with reduced adherence to guidelines in Croatia (Pavela Banai et al., 2020), Germany (Bruder & Kunert, 2021; Pummerer et al., 2021) and Serbia (Karić & Mededović, 2021).

For citizens in the United States, belief in COVID conspiracy theories was associated with *more* trust in the country's government (van Mulukom, 2020) and President Trump (Earnshaw et al., 2020), but at the same time *less* trust in one's state and local government (Earnshaw et al., 2020). This suggests that trust in governmental institutions is further complicated by political ideology. However, distrust in science and research, and distrust in political institutions together predicted COVID-19 conspiracy beliefs in Austria more strongly than right-left ideology (Eberl et al., 2021). Similarly, in German and Swiss samples, extremes on both sides of the political ideology (i.e., left and right) were associated with increased endorsement of conspiracy theories (Kuhn et al., 2021). Thus, COVID-19 conspiracy beliefs may be predicted by populist attitudes, fuelled by anti-elitism (i.e., a broad breakdown of trust in mainstream authorities as credible sources of information), rather than particular political ideologies (Eberl et al., 2021; Rothmund et al., 2020). In line with this suggestion, COVID-19 conspiracy beliefs have been associated with trust in one's government for countries with populist governments (e.g., Brazil, United Kingdom, United States), but with distrust for countries without these types of governments (e.g., Finland, New Zealand) (van Mulukom, 2020).

Trust in various types of media further modulates belief in conspiracy theories. Reliance on, or trust in, social media is associated with COVID-19 conspiracy beliefs in multinational (De Coninck et al., 2021; van Mulukom, 2020), U.S. (Earnshaw et al., 2020), South Korean (Kim & Kim, 2021) and Middle-Eastern samples (Sallam et al., 2021). Similarly, trust in less serious, more sensational newspapers such as 'tabloids', is associated with COVID-19 conspiracy beliefs in the United Kingdom (Hartman et al., 2021). Sometimes however, mistrust in traditional news outlets may be explained by participants indicating they felt that the news outlets were a 'mouthpiece' of the government, an effect which was intensified for people who engaged with news sources from other countries (Lockyer et al., 2021). Similarly, scepticism towards Chinese media mediated the effect of international social media use on belief in conspiracy theories (Su et al., 2021), an effect which the authors suggest may be due exposure to diversified, heterogeneous media agenda reducing echo chamber effects and simplistic perspectives.

Social Media

Social media platforms have been major contributors to the COVID-19 infodemic (M. S. Islam et al., 2020a), overloading users with (mis)information (Zarocostas, 2020), such as the film 'Plandemic', which quickly gained millions of views (Kaplan, 2020). Although not all social media posts containing a related hashtag (e.g., #5GCoronavirus) endorse a conspiracy theory (Ahmed et al., 2020b) and although some social media companies have responded to the proliferation of dangerous

misinformation about COVID-19 on their platforms (Kelion, 2020; B. Quinn, 2020), conspiratorial claims are among the most attention-grabbing content on social media (Marchal & Au, 2020; Mutanga & Abayomi, 2020; Rovetta & Bhagavathula, 2020), an important content effect on the learnability and believability of conspiracy theories. Like other conspiracy theories, COVID-19 conspiracy theories shared over social media are transmitted more rapidly and reach broader audiences than fact-checked information (Bruns et al., 2020; Rodríguez et al., 2020). The more rapid transmission of COVID-19 conspiracies may be driven by a more negative valence of COVID-19 conspiracy misinformation relative to other kinds of COVID-19 (mis)information shared over social media (Charquero-Ballester et al., 2021).

Social media bots may be a large driver of COVID-19 conspiracy diffusion. Twitter accounts ranked most likely to be a bot were 27 times more likely to tweet about COVID-19 than accounts ranked least likely to be bots (Ferrara, 2020). These accounts were also highly engaged in spreading conspiratorial, right-wing political propaganda related to COVID-19 (e.g., Chinese bioweapon theories), linking to conservative partisan websites or YouTube as references (Ahmed et al., 2020a). The sheer repetition of information in the created echo chambers may render it trustworthy on appearance (Unkelbach et al., 2019), and the large group of apparent ‘individuals’ posting the theories might steer into biases like the bandwagon bias (Anderson, 2019).

(Extreme) right-wing ideology is another major driver of COVID-19 conspiracy theories and misinformation on social media platforms (Marone, 2021) and other right-leaning news outlets (Motta et al., 2020). Individuals with conservative leanings, relative to liberals, report a higher willingness to share COVID-19 conspiracy theories over social media (Lobato et al., 2020). Users tweeting in support of right-wing narratives were more likely to retweet COVID-19 conspiracy theories than users who were either neutral or who tweeted in support of left-wing narratives (Jiang et al., 2020). Pro-Trump Twitter accounts are a substantial contributor to the continuation of claims that COVID-19 is a hoax (Gruzd & Mai, 2020), and Trump’s own Twitter messages have likely contributed to increases in anti-vaccination attitudes in his supporters (Hornsey et al., 2020). Likewise, the idea that the media exaggerates COVID-19 and that there is a lot of ‘fake news’ out there has been correlated with the belief that COVID-19 was artificially created (van Mulukom, 2020). Geospatial analysis revealed that COVID-19 conspiracy theories propagate over social media more in countries like the United States, where right-wing politicians repeat online conspiracy theories (Stephens, 2020).

Conspiratorial thinking is predicted by trust in social media outlets as sources of information (Earnshaw et al., 2020; Kim & Kim, 2021; Sallam et al., 2021; van Mulukom, 2020). People who used social media (vs. mainstream news outlets) as informational sources of COVID-19 were also more likely to endorse COVID-19 conspiracy theories (Bridgman et al., 2020; De Coninck et al., 2021; Freeman et al., 2020b), but less likely to follow COVID-19 health protective behaviours (Allington et al., 2020). Similarly, social media users who shared conspiratorial claims were less likely to engage in online discussions on public health or COVID-19 prevention (Jiang et al., 2020),

and social media users who reported a greater preference for exposure to and engagement with diverse political views were less likely to endorse the view that COVID-19 was created intentionally in a lab (Su, 2021).

Consequences

Protective Behaviours

For all COVID-19 conspiracy theories except the hoax and exaggeration/flu theories, SARS-CoV-2 is considered real and dangerous, and as such, engagement in protective behaviours would still be expected. However, these behaviours come in many forms (see Table 2), with some overlapping recommended safety guidelines (i.e., safeguarding behaviours) and others not overlapping with recommended safety guidelines (e.g., hoarding or pseudoscientific health practices). In this section, we will discuss associations between these varying practices and COVID-19 conspiracy theory endorsements.

Table 2

Overview of examples of protective behaviours during the COVID-19 pandemic

Safeguarding behaviours			Self-centred behaviours	Misguided behaviours
<i>Hygiene</i>	<i>Distancing</i>	<i>Mask wearing</i>	<i>Hoarding</i>	<i>Pseudoscientific health practices</i>
<ul style="list-style-type: none"> ▪ Disinfecting hands ▪ Washing hands ▪ Not touching the face ▪ Covering mouth/ nose when coughing/ sneezing ▪ Cleaning/ disinfecting home 	<ul style="list-style-type: none"> ▪ Avoiding social contacts ▪ Avoiding crowds ▪ Staying at home in quarantine ▪ Avoiding shaking hands with other people ▪ Avoiding any physical contact with other people ▪ Keeping a safe 	<ul style="list-style-type: none"> ▪ Wearing protective face masks out of the house ▪ Wearing an N-95 or higher (health grade) mask 	<ul style="list-style-type: none"> ▪ Stocking up on food, water, toilet paper and/or sanitary items ▪ Buying weapons for defence and security purposes ▪ Stocking up on petrol and oil ▪ Buying equipment for water storage and water 	<ul style="list-style-type: none"> ▪ Using alternative remedies like homeopathy or essential oils ▪ Consuming information from alternative sources online

distance from others	purification
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Note. Examples adapted from Imhoff & Laberty (2020) and van Mulukom (2020).

Safeguarding Behaviours

Over the course of the pandemic, governments and official health institutions issued behavioural guidelines aimed at reducing the spread of the disease. Among the safeguarding behaviours are hygiene-, distancing-, and mask-related guidelines, which all have been effective in curbing the virus (N. Islam et al., 2020b; Leung et al., 2020), but might be differently predicted by COVID-19 conspiracy beliefs (Farias & Pilati, 2021; Imhoff & Lamberty, 2020; Oleksy et al., 2020). Overall, self-reported adherence to these guidelines when taken together was negatively related to COVID conspiracy beliefs (Allington et al., 2020; Bierwiazzonek et al., 2020; Constantinou et al., 2020; Erceg et al., 2020; Fountoulakis et al., 2020; Freeman et al., 2020b; Karić & Mededović, 2021; Kowalski et al., 2020; Maftai & Holman, 2020; Oleksy et al., 2020; Pavela Banai et al., 2020; Romer & Jamieson, 2020; Soveri et al., 2021; Swami & Barron, 2021; Teovanovic et al., 2020) across countries and with r -values mostly ranging between $r = -.20$ and $-.50$. However, there was also a small number of studies that did not find a relation (Alper et al., 2020; Čavojská et al., 2020a; Juanchich et al., 2021) or no unique effect of COVID conspiracy beliefs on guidelines (Díaz & Cova, 2020) (Soveri et al., 2021).

Some studies measured adherence to hygiene and distancing guidelines are measured separately. Here, adherence to distancing guidelines was generally lower than adherence to hygiene guidelines and in some cases, only the former was related to COVID conspiracy belief (in U.S. & English samples, Biddlestone et al., 2020; in Germany, Bruder & Kunert, 2021; in Brazil, Farias & Pilati, 2021; in Poland, Kowalski et al., 2020; in France, Marinthe et al., 2020; in Germany, Pummerer et al., 2021), research suggests that general and COVID-19 conspiracy beliefs are negatively associated with adherence to distancing guidelines, but not to hygiene guidelines. Moreover, belief in COVID-19 conspiracy theories predicted reduced adherence to distancing guidelines in a longitudinal study with a U.S. sample (Bierwiazzonek et al., 2020). Mask-wearing was typically measured together with the other safeguarding behaviours (Imhoff & Lamberty, 2020), but, when measured separately, behaved in ways similar to the other safeguarding behaviours (Hornik et al., 2021; van Mulukom, 2020).

The full picture as to why there might be differences in the relation between COVID-19 conspiracy beliefs and adherence to hygiene versus distancing guidelines has not yet emerged. People high in conspiratorial thinking seem to prefer non-normative actions and behaviours which go against governmental regulations (Jolley et al., 2019; Marinthe et al., 2020). As the governmental interference had more tangible consequences for distancing guidelines – for example through lockdowns or regulations – people high in conspiratorial thinking might have been more likely to express their disagreement through not following distancing guidelines as compared to hygiene measures. This idea

is supported by studies reporting that distrust in governmental officials mediated the association between COVID-19 conspiracy beliefs and adherence to guidelines (in Serbia, Karić & Međedović, 2021; in Croatia, Pavela Banai et al., 2020; however, see also in Germany, Pummerer et al., 2021), and conspiracy beliefs mediated the effect of trust in non-populist governments and scientists on hygiene and distancing behaviours (van Mulukom, 2020).

Additionally, support and adherence to guidelines seem to differ between beliefs in different kinds of conspiracy theories (Farias & Pilati, 2021; Oleksy et al., 2020; though see Karić & Međedović, 2021). Believing in conspiracy theories claiming that the coronavirus SARS-CoV-2 is a hoax or caused by 5G is more negatively related to the adherence to guidelines than believing that the virus is artificially created, potentially as a bioweapon in the United Kingdom (Allington et al., 2020; Imhoff & Lamberty, 2020) and United States (Imhoff & Lamberty, 2020), which may follow from the fact that the latter conspiracy theories still assume that the virus is dangerous (Chan et al., 2021). The finding that generic conspiracy ideation is associated with both reduced compliance to distancing guidelines and reduced perceived risk in a Romanian sample supports this idea (Maftei & Holman, 2020). Also, the artificial origin COVID-19 conspiracy belief predicted hygiene but not distancing behaviours in a multinational sample (van Mulukom, 2020).

Several variables mediate the relationship between endorsement of COVID-19 conspiracy theories and adherence to guidelines. Conspiracy mentality is related to a higher perceived risk of death and thus motivation to protect oneself, which mediated agreement with confinement in a French sample (Marinthe et al., 2020). Furthermore, the relationship between COVID-19 conspiracy beliefs and adherence to guidelines was mediated by distrust in science in a multinational sample (Plohl & Musil, 2020), and feelings of powerlessness in a UK and U.S. sample (Biddlestone et al., 2020).

Self-centred Behaviours

Believing in COVID-19 conspiracies is related to greater concerns for oneself than others (Hornsey et al., 2021). COVID-19 conspiracy beliefs have predicted hoarding in several countries (predominantly the United States) (Bai, 2020; Imhoff & Lamberty, 2020; Juanchich et al., 2021; van Mulukom, 2020), possibly reflecting the fact that hoarding items can help people to regain a sense of security and control (Arafat et al., 2020). This idea is supported by the finding that self-centred prepping behaviour — hoarding goods and using alternative remedies — was predicted differently depending on the type of conspiracy theory that was endorsed in an early study with samples from Germany, United States and the United Kingdom (Imhoff & Lamberty, 2020): Individuals were more likely to engage in self-centred prepping behaviour when they believed that COVID-19 was artificially created than when they believed that it was a hoax. Hoarding behaviours during the COVID-19 pandemic may further be spurred on by greater perceived threat, such as through concerns for food shortages (Jovančević & Milićević, 2020), low income (Juanchich et al., 2021), and Dark Triad personality traits (Nowak et al., 2020).

Misguided Behaviours

Typically viewed as harmless, many non-evidence-based health practices can be deceptive at best and very dangerous at worst during the pandemic (Freckelton Qc, 2020). Practices range from drinking ginger tea or consuming garlic to ingesting deadly substances such as methanol or disinfectant, in the belief that they are “miracle cures”. The short film ‘Plandemic’ for example, which appeared online on May 4th of 2020, called itself a documentary (Allen, 2020) despite containing a large number of falsities (Neil & Campbell, 2020), many related to such pseudoscientific health practices. These practices have become so widespread that the WHO even had to put up an official website to fact-check and debunk them (World Health Organization, 2020). Endorsing pseudoscientific health practices has repeatedly been linked to a conspiratorial worldview (Lobato et al., 2014), as have COVID-19 conspiracy beliefs: in Slovakia, endorsement of COVID-19 conspiracy theories was related to pseudoscientific but not recommended protective behaviours (Čavojová et al., 2020a). Robust relations between pseudoscientific preventive practices and belief in political and general COVID conspiracy theories have also been found in Germany (Pummerer et al., 2021) and Serbia (Teovanovic et al., 2020). Low levels of information and a self-centred focus on protection (associated with low levels of trust) may be driving this effect, though in a Chinese sample, there was a significant correlation between taking vitamin supplements or herbal medicine and trust in the government for those with low levels of COVID-19 knowledge (Min et al., 2020).

Other health and social consequences

Belief in conspiracy theories have been consistently linked to negative attitudes towards vaccinations (Hornsey et al., 2018), which are one important factor of how well humankind is able to deal with preventable diseases. Conspiracy beliefs about COVID-19 are no exception: They are similarly associated with reduced intentions to vaccinate. In addition, interactions with lower psychological wellbeing are also found. Along with detrimental effects on individual and public health, COVID-19 conspiracy beliefs are also shown to decrease the social capital and intergroup relations, through prejudice, discrimination and violence.

Vaccination Intentions

Since the onset of the COVID-19 pandemic, it has become clear that SARS-CoV-2 will stay with us for a long time, which has started a race to develop a vaccine. Vaccine hesitancy (Sallam, 2021) has consistently been linked to COVID-19 conspiracy beliefs (Allington et al., 2021; Bertin et al., 2020; Cislak et al., 2020; Freeman et al., 2020a; Freeman et al., 2020b; Hornsey et al., 2021; Hughes & Machan, 2021; Romer & Jamieson, 2020; Ruiz & Bell; Salali & Uysal, 2020; Sallam et al., 2021; Soveri et al., 2021; Teovanovic et al., 2020)(r -values from .28 to .48), and those with conspiracy beliefs require the vaccine to have a higher efficacy for them to be willing to take it up (Hursh et al.,

2020). This may undermine the potential for herd immunity against SARS-CoV-2, as the majority of the population will need to either overcome the disease or be vaccinated to achieve herd immunity (Fontanet & Cauchemez, 2020).

In addition to being associated with thinking style antecedents, such as higher intuitive and biased thinking (Teovanovic et al., 2020; Tomljenovic et al., 2020), and lower analytic and scientific thinking (Čavojová et al., 2020a), unwillingness to get vaccinated is also associated with lower trust in sources providing information about COVID-19, lower adherence to recommended guidelines, and higher endorsement of complementary and alternative medicine (Soveri et al., 2021). Generally, the available data suggest that higher intentions of getting vaccinated are predicted by a higher perceived risk of COVID-19 (Glöckner et al., 2020; Malik et al., 2020), though concern for self (rather than others) mediated the link between conspiracy ideation and vaccination reluctance (Hornsey et al., 2021).

Because the COVID-19 vaccines are new, people have to base their risk perception mostly on their experience and knowledge of existing vaccines. Unfortunately, vaccination attitudes can be influenced by misinformation (e.g., that Measles, Mumps and Rubella (MMR) vaccine causes autism; Jolley & Douglas, 2014a) and conspiracy theories (e.g., that vaccines are for mind control; Blaskiewicz, 2013). Intentions to vaccinate against COVID-19 were shown to be negatively connected with strong general anti-vaccination attitudes, COVID-19 conspiracy beliefs, and epistemically suspect beliefs in general (Bertin et al., 2020; Čavojová et al., 2020a; Soveri et al., 2021; Teovanovic et al., 2020). Confusion due to the overwhelming amount of constant information, distress from emotive negative messages, and distrust following incompetence in the governments' responses and conflicting stories from different sources may further negatively impact vaccination intentions (Lockyer et al., 2021). There is a complex interplay of factors at work here: Although higher intentions to get vaccinated have been predicted by worry (Faasse & Newby, 2020; Ward et al., 2020), and concern about how threatening the disease is considered to be (Karlsson et al., 2020), belief in COVID-19 conspiracy theories may cancel these effects out: Perceived threat and helplessness may also reduce intentions to get vaccinated, when they concurrently increase belief in COVID-19 conspiracy theories (Šrol et al., 2021b).

Psychological wellbeing

Believing in COVID-19 conspiracy theories has been associated with greater (future) anxiety, a sense that one lacks control, feelings of powerlessness, and higher levels of uncertainty (Biddlestone et al., 2020; Duplaga & Grysztar, 2021; Miller, 2020a, b; Sallam et al., 2020a; Šrol et al., 2021b) as well as momentary stress (Kuhn et al., 2021), higher levels of depression (De Coninck et al., 2021; Fountoulakis et al., 2020), negative emotions (Kim & Kim, 2021), and less resilience (Miller, 2020b), though non-significant relations among belief in different COVID-19 conspiracy theories and increased levels of stress have also been reported (Georgiou et al., 2020). Belief in the artificial

creation theory, but not the theories that the virus occurred naturally, was related to more anxiety, psychological distress, and less life and job satisfaction in a study among healthcare workers in Ecuador (Chen et al., 2020). Indeed, conflicting or confusing information can be particularly inflammatory to psychological wellbeing, especially when threatening (such as conspiracy theories) or when combined with the relentless stream of negative news on social networks and media (Amanzio et al., 2020; Mukhtar, 2021). For example, belief in COVID-19 conspiracy theories, feeling insufficiently informed, and a lack of trust in the readiness of the government to deal with the pandemic, were associated with greater feelings of hopelessness during the early stages of quarantine in Russia (Egorova et al., 2020). Moreover, feelings of anxiety and depression mediated the negative association between exposure to traditional media and conspiracy beliefs, and the positive association between exposure to social media (and information from family and friends) and conspiracy beliefs (De Coninck et al., 2021).

Believing in conspiracy theories generally has been associated with mental health disorders and decreased well-being (Freeman & Bentall, 2017). However, the direction of this relationship between conspiracy beliefs and psychological wellbeing is not yet fully understood. It might be that low psychological wellbeing increases the likelihood of endorsement of conspiracy theories, as experimentally manipulating COVID-19 threat leads to a greater belief in COVID-19 conspiracy theories, and this was mediated by increased feelings of fear and anxiety (Jutzi et al., 2020). Likewise, heightened anxiety (Grzesiak-Feldman, 2013) and the perception of lack of control (Whitson & Galinsky, 2008) has been associated with belief in general conspiracy theories. At the same time, however, belief in conspiracy theories themselves might also lead to lower psychological wellbeing, as being exposed to conspiracy theories led to feelings of powerlessness in political (Jolley & Douglas, 2014b) and health (Jolley & Douglas, 2014a) contexts, as well as to higher feelings of anomie (Jolley et al., 2019), which describes perceptions of alienation, disorderliness of the (social) world and general dissatisfaction. Overall, it seems likely that conspiracy beliefs and lower psychological wellbeing interact and strengthen each other (Douglas et al., 2017) and believing COVID-19 conspiracy theories may lead to lower psychological wellbeing in the long term, for example through associations of feelings of powerlessness and uncertainty (Duplaga & Grysztar, 2021), though conspiracy beliefs may also be used as a maladaptive coping mechanism (Fountoulakis et al., 2020).

Negative social Consequences

An effective response to a pandemic requires a coordinated effort of actors within and across countries. In the case of COVID-19, however, this cooperation has been undermined from the outset by people engaging in blame games (Jakovljevic et al., 2020) and ‘us (ingroup) versus them (outgroup)’ narratives associated with the endorsement of COVID-19 conspiracy theories (Kim & Kim, 2021). Indeed, blaming China for the virus is significantly predicted by generic conspiracy

ideation (Prichard & Christman, 2020) and nationalist conspiracy theorizing (e.g., blaming China or the United States for spreading COVID-19), that reinforced both nationalism and a deep lack of trust between countries (Nie, 2020). People who believe in the artificial origin of COVID-19 report a greater willingness to penalize China and less support for biomedical research of zoonotic viruses (Bolsen et al., 2020). Existing social and economic inequalities (realistic threats) are exacerbated by the spread of the virus, which was shown to disproportionately affect minority groups, as well as by the growing mutual distrust associated with the proliferation of COVID-19 conspiracy beliefs (Jaiswal et al., 2020). This all points to the great need to understand the negative social consequences of the current pandemic, such as the spread of prejudice, social and economic inequality, xenophobia, racism, extremism, and violence (Abrams et al., 2021), which are intertwined with belief in COVID-19 conspiracy theories (Hardy, 2020; Jaiswal et al., 2020; Levinsson et al., 2021; Marone, 2021; Šrol et al., 2021a), as behaviours geared at reducing perceived threat.

Early in the pandemic, exposure to information about COVID-19 led to negative attitudes against Asian people (Sorokowski et al., 2020), and the belief that the virus was artificially created was associated with the tendency to avoid Asian food and restaurants (van Mulukom, 2020). Negative social effects like prejudice are likely driven by perceived threat (to the individual or their group), such as described in conspiracy theories with threatening outgroups and such as repeated by social media: Perceived, rather than actual, threat from the COVID-19 pandemic (Mandalaywala et al., 2020) and framing of COVID-19 as an existential threat (Tabri et al., 2020) were associated with greater prejudice toward Asian people and the desire for social distance from them. Desired social distance from Asian, Hungarian and Italian individuals was also predicted by increased exposure to media predicted in participants from the United Kingdom and Poland (Sorokowski et al., 2020), and the effect of information exposure on prejudice toward Italians was mediated by anxiety. In a Polish sample, only belief in COVID-19 conspiracy theories which feature a powerful and threatening outgroup (e.g., COVID-19 is intentionally being spread for a benefit of certain groups) led to negative feelings toward Chinese (and Italian) people and increased support for xenophobic public policies (Oleksy et al., 2020).

In conspiracy research literature, belief in conspiracy theories has been associated with hostility (Abalakina-Paap et al., 1999; Marchlewska et al., 2019), support for violent and non-normative political actions, such as participating in illegal demonstrations, or verbal and physical intimidation and harassment of people (Imhoff et al., 2021), and everyday crimes (Jolley et al., 2019). COVID-19 conspiracy theories are no exception: Since the spread of the theory that COVID-19 is caused or spread by 5G technologies, there have been numerous public demonstrations, documented cases of abuse of technicians at mobile phone towers, and arsons (Meese et al., 2020). Generic COVID-19 and 5G COVID-19 conspiracy beliefs have also been associated with greater anger, which in turn was associated with higher levels of justification and willingness to engage in violence, such as setting cell phone towers ablaze (Jolley & Paterson, 2020), or participating in violent anti-government

protests (Šrol et al., 2021a). More generic COVID-19 conspiracy beliefs were furthermore related to higher sympathy for violent radicalization among Canadian young adults, especially those with higher reported levels of psychological distress (Levinsson et al., 2021). Extremists, ranging from jihadists to left-wing extremists, but in particular right-wing extremists, have used the pandemic to further their propaganda, recruit sympathisers, and lash out against their usual enemies through conspiracy theories (Marone, 2021).

Discussion

The COVID-19 pandemic is an extraordinarily challenging time for many: Not only do people have to deal with the possibility of catching a potentially debilitating and even lethal disease, they also have to deal with many uncertainties about the future that have implications for their social relationships, health, and economic well-being. While COVID-19 has been experienced as challenging for many, but not all endorse COVID-19 conspiracy beliefs. Here, we conducted a rigorous systematic review of the current evidence of the antecedents and consequences of COVID-19 conspiracy beliefs. We believe this systematic review is a reasonable representation of the phenomenon of interest and have high confidence in the results.

In terms of antecedents, COVID-19 conspiracy beliefs were consistently though somewhat weakly (r -values .12-.33) associated with Dark Tetrad personality traits (narcissism, Machiavellianism, psychopathy, and sadism), with similar associations for paranoia and delusional ideation (r -values .18-.44). Similar small but consistent associations were found between COVID-19 conspiracy beliefs and lack of control (r -values .18-.28), feelings of uncertainty and uncertainty avoidance (r -values .12-.57) and perceived risk and anxiety (r -values .10-.29). Though many researchers suggested these associations are likely bidirectional, one longitudinal study showed a small causal effect of anxiety increasing COVID-19 conspiracy beliefs over time (Heiss et al., 2021). In terms of thinking styles, COVID-19 conspiracy beliefs were associated with lower performance on a behavioural measure of analytical thinking (r -values -.18 to -.46), with greater correlations when numeracy, science literacy, and bullshit receptivity were also taken into account (Pennycook et al., 2020a). Smaller effects were found for self-report measures of thinking styles, though they were in the same direction: more intuitive and less analytical thinking styles were related to higher levels of COVID-19 conspiracy beliefs (r -values .13-.28). In line with these findings, small but consistent correlations were found between COVID-19 conspiracy beliefs and epistemically suspect beliefs (r -values .23-.56).

The association between COVID-19 conspiracy beliefs and trust in science were similar in range to these previous correlations (r -values from -.20 to -.47, and β -values from -.16 to -.42): the less people trust science, the more they endorse conspiracy theories. Similarly, distrust in scientists, health experts and health institutions were associated with COVID-19 conspiracy beliefs (r -values -

.19 to -.30). A more complicated picture arose with regards to governments: generally speaking, COVID-19 conspiracy belief was associated with and predicted by distrust in one's government (r -values -.12 to -.35; β -values -.08 to -.48, Cohen's $d = .32$) and to a lesser extent international organisations (r -values -.07 to -.17), but with *trust* in President Trump or populist governments (β -values .15-.23, Cohen's $d = .76$). COVID-19 conspiracy beliefs were also linked to collective narcissism (r -values .27-.48), support for xenophobic policies ($r = .35$), and political conservatism and religiosity in the United States. COVID-19 conspiracy beliefs were consistently predicted by trust in, and reliance on, social media, in particular Facebook (β -values .08-.10, $r = .13$, Cohen's $d = .51$), though distrust in mainstream media seemed to be even greater ($\beta = -.37$). COVID-19 conspiracy belief research on social media has particularly focused on conspiracy theories and misinformation has been spread, which appeared to mostly take place on social media platforms (the majority of this research was descriptive and qualitative however). Interestingly, the spread of COVID-19 conspiracy theories has been consistently associated with politically conservative attitudes and narratives, even when those attitudes and narratives are not directly connected to COVID-19 per se.

In terms of consequences, the main consequence of COVID-19 conspiracy belief that has been investigated was adherence to safeguarding behaviours. In general, COVID-19 conspiracy was negatively related to adherence to hygiene and physical distance guidelines (r -values between -.20 and -.50), whereby correlations for adherence to physical distancing guidelines were usually larger than the ones for hygiene measures. Adherence to guidelines seemed to be mediated by trust towards the government and feelings of powerlessness. COVID-19 conspiracy belief was positively correlated with self-centred behaviours however, such as hoarding goods (r -values .17-.71), and with misguided behaviours, such as pseudoscientific practices (r -values .18-.28). With regard to other health and social consequences, correlations of COVID-19 conspiracy beliefs to vaccination intentions were generally somewhat larger though still modest (r -values .28-.48). COVID-19 conspiracy belief was generally associated with lower psychological wellbeing, whether higher levels of anxiety, depression, feelings of powerlessness and uncertainty (r -values .18 to .31), though the (bi)directionality of these effects is not clear. Finally, a wide range of negative social consequences has been examined, ranging from prejudice and discrimination to justification and willingness to engage in violent actions, and sympathy for violent radicalization. In general, however, the correlations between COVID-19 conspiracy beliefs and these negative social consequences was positive (r -values .11-.60).

The main aim of this systematic review as to synthesise the current research on COVID-19 conspiracy beliefs to make it widely accessible. We believe that we have met this aim. Compared to other systematic reviews however, this systematic review does not really identify new interesting questions that future systematic reviews could assess (Johnson & Hennessy, 2019). Rather, what the literature shows us is that the COVID-19 conspiracy belief research so far has focused on applying previous conspiracy belief research ideas to the context of the COVID-19 pandemic. While this is a

highly specific context, overall it was shown that the conspiracy beliefs function much like other conspiracy beliefs (and high correlations between COVID-19 and generic conspiracy beliefs or measures of conspiracy mentality have been found). It comes therefore as no surprise that the correlations we found were consistent, and that few if any studies found non-significant correlations were expected (though this effect may have been confounded by a lack of many pre-registered studies).

The effect sizes of the reviewed articles were similar to each other, in particular for correlation coefficients, which on average ranged from approximately $r = .16$ to $r = .40$ (ignoring positivity/negativity), so demonstrating weak to moderate correlations. The majority of the reviewed research was cross-sectional. Therefore, the direction of any effect(s) is not clear and might also be the result of a multidirectional effect or the cause of additional variables. Thus, further examinations of COVID-19 conspiracy beliefs would greatly benefit from (a combination of) experimental or longitudinal approaches (e.g., Pummerer et al., 2021). Longitudinal studies (e.g., Bierwiazzonek et al., 2020) are especially interesting as they can take into account the continuously evolving situation of the pandemic. Additionally, a variety of modelling techniques could be used to examine who is inclined to share conspiracy beliefs (including machine learning and network analysis).

Furthermore, more attention to, and variety in, samples would be desirable: A considerable number of the studies were using convenience samples, usually comprised of people who are skilful in using computers (as most studies were completed online), from a relatively select number of countries and regions, typically those where the researchers themselves are based (the United States and the United Kingdom), with few studies with well-executed country comparisons (for an exception, see De Coninck et al., 2021). The need for samples from underrepresented continents, specifically Africa and Asia, is well-known (Henrich et al., 2010). Cross-national differences are a next point of future investigation, as varying cultural and political situations, including populist governments, invariably influence both the antecedents and consequences of conspiracy beliefs (e.g., see Adam-Troian et al., 2020), effects of which we saw particularly in studies with samples from Slovakia, Romania, and the United States – countries with governments which at times supported protests and/or at least did not hinder the spread of COVID-19 conspiracies theories. In this systematic review, cross-national comparisons could often not be made here due to varying methodology, samples, etc. Therefore, we urge researchers to consider these factors for future research, for example whether there is any bias towards certain countries and samples which influences the generalisability of the results. Moreover, as conspiracy beliefs seem to be more prevalent in specific subgroups, such as minority groups (Earnshaw et al., 2020; Freeman et al., 2020b), it would be informative for future research to specifically target these subgroups, through different methods of recruiting if necessary.

Many studies averaged belief in various COVID-19 conspiracy theories together, or focused on generic conspiracy belief or conspiracy ideation. The current review demonstrates that COVID-19

conspiracy theories differ in the accused outgroup and/or behavioural consequences, questioning whether they are always monological (Miller, 2020a). A broad division can be made between *questioning COVID-19 conspiracy theories*, which question the severity of the virus and pandemic, such as hoax conspiracy theories or those suggesting COVID-19 is like the flu (honing in on the uncertainty aspect of conspiracy theories) and *blaming COVID-19 conspiracy theories*, which assume a purposeful origin/spread of the virus (though the cause or powerful actors behind it may be hidden), such as bioweapon, political control, or Bill Gates/5G theories (honing in on the threat aspect of conspiracy theories). Here we found stronger effect sizes for blaming than questioning conspiracy theories in relation to safeguarding behaviours. Therefore, some caution regarding differences between COVID-19 conspiracy theories is needed in future research, and additional research may be warranted (Enders & Smallpage, 2018). Similar attention to the heterogeneity of believers and their worldviews, quantifying any subtle differences, could be beneficial herein (Franks et al., 2017). Many studies also did not distinguish between different types of safeguarding behaviours either (e.g., hygiene versus social distancing), despite the differential effects that conspiracy beliefs had on these behaviours.

Not all studies reported the time that the surveys were conducted; however this does matter, which is unsurprising given that COVID-19 conspiracy beliefs are a social and political issue. For example, early surveys examining vaccination intentions arguably measured a more abstract intention than surveys later on, when vaccinations had actually become available. Moreover, effect sizes relating conspiracy beliefs to safeguarding behaviours increased as governments increased pressure through regulations, which depended both on the time of the survey and country investigated.

Here, we conducted a systematic review using PRISMA protocol (Moher et al., 2009) and AMSTAR 2 Checklist (Shea et al., 2017). We cast the net wide by initially including all studies involving the words COVID-19 or coronavirus in combination with conspiracy belief or theory, before excluding those that did not contain empirical data, did not include research to do with COVID-19 conspiracy beliefs, or was not written in English. Since we also included preprints, checked four major databases, and had co-authors search through reference lists and other venues, it is unlikely we missed many articles published on COVID-19 conspiracy beliefs research before March 2021. We only had to exclude one article which was written in Russian (Zakharova et al., 2021), as we did not have the language skills to assess this research. Focusing on just English articles means we have missed this research, and there may be additional research out there we have missed, which is a limitation that should be noted (Johnson & Hennessy, 2019). The broad focus of this systematic review also meant that there was a broad range of research designs and methodologies, rendering a meta-analysis less practical. Here we have instead reported effect sizes (predominantly in the form of correlation coefficients) in an attempt to contextualise the results statistically. There are few systematic reviews of conspiracy belief research (Goreis & Voracek, 2019), but it is a fast-growing field. As such, we hope that the recommendations put forward in this research will be taken into

consideration in future research, so that the research and science of conspiracy beliefs may improve further, allowing us to get a better understanding of this interesting but also highly important phenomenon.

The practical value of this review should not be overlooked: In order to deal with what is already an extremely challenging time, government and healthcare officials can gain much from understanding what may lead to conspiracy beliefs during the COVID-19 pandemic, and what the consequences of such beliefs might be, especially since these consequences have effects on the whole populations, not just a subgroup of believers. Besides the negative social consequences described in the present article, the psychology of political extremism (van Prooijen et al., 2015) and violent political action (Lamberty & Leiser, 2019) have also previously been associated with conspiracy beliefs but have rarely been studied in the context of the current pandemic. Together with the increase in polarisation that conspiracy theories and other disinformation bring about, conspiracy theories can ultimately also pose a threat to democracies by calling into question the integrity of authorities, policies, and electoral processes (Vériter et al., 2020). In other words, COVID-19 conspiracy beliefs are a pressing social issue of which we have put forward antecedents that policy makers and practitioners could consider for interventions and other mechanisms through which the challenges of such conspiracy beliefs can be challenged.

COVID-19 conspiracy beliefs, like other conspiracy beliefs, are marked by misinformation and mistrust in (mainstream) authorities and media. Understanding how antecedents lead to conspiracy beliefs – in particular in interaction with each other, something which is currently still underresearched - is highly important to develop measures to tackle conspiracy beliefs and their detrimental consequences: whether in the current pandemic or future threats, such as those linked to climate change.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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