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Beliefs in Times of Corona: Investigating the Relationship Between Media Use and COVID-19 Conspiracy Beliefs Over Time in a Representative Dutch Sample

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We investigated the relationship between different media sources (traditional media, online news media, online health sources, social media) and COVID-19 related conspiracy beliefs, and how these change over time, using four-wave panel data from a representative sample of the Dutch population (N = 1,166). Across waves, 0.1%–3.4% of our sample were certain the selected conspiracy theories were true, though this belief was unstable over time. Random intercept cross-lagged panel models revealed that individuals' temporary level of conspiracy beliefs did not significantly depend on their temporary level of media use at a previous occasion, or vice versa. However, significant correlations at the group level indicated that more frequent use of health-related and social media sources were associated with higher levels of conspiracy beliefs. These results suggest that relationships between media use and conspiracy beliefs are nuanced. Underlying processes should be investigated to develop tailored communication strategies to combat the ongoing infodemic.

Keywords: media use, digital media, conspiracy beliefs, misinformation, COVID-19, random intercept cross-lagged panel models

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The COVID-19 pandemic has been dominating our lives since early 2020, with cumulative infection rates of many millions of cases, including millions of deaths worldwide as of March 2021 (World Health Organization [WHO], 2020a). Besides this viral pandemic, the WHO has warned against an ongoing "infodemic": the existence of an overwhelming amount of information about the coronavirus, of which some is accurate, some is not (WHO, 2020b). Due to this information overload, many people experience difficulties disentangling accurate information from misinformation.

Generally, scholars refer to inaccurate or unverified claims as misinformation (e.g., Nyhan & Reifler, 2010; Su, 2021). Misinformation is the overarching term to which conspiracy theories and conspiracy beliefs belong. Conspiracy theories are propositions that are based on the idea that major social or political events, such as the coronavirus pandemic, are plotted by powerful and malicious individual(s) (Aaronovitch, 2010; Douglas et al., 2019). They are often believed by groups of people with a common intention (e.g., to challenge the government). Due to the potential detrimental impact of conspiracy beliefs on fighting the coronavirus pandemic, we focus on the belief in COVID-19 conspiracy theories and its relationship with media consumption.

Since the start of the pandemic, many conspiracy theories about the origin, impact, and treatment of the coronavirus have circulated, ranging from the virus being a secret Chinese bioweapon (Woodward, 2020) to a patented invention from Bill Gates (Huff, 2020). Beliefs in such unverified or inaccurate information may harm societal response toward the pandemic. Several studies found that conspiracy beliefs negatively relate to adherence to COVID-19 preventive measures (e.g., Allington, Duffy, Wessely, Dhavan, & Rubin, 2020; Freeman et al., 2020) such as wearing face masks (Romer & Jamieson, 2020) or practicing physical distancing (Pummerer et al., 2020). Moreover, belief in COVID-19 conspiracy theories has been associated with vaccination hesitancy (Freeman et al., 2020; Romer & Jamieson, 2020). To reiterate: Effectively combating a pandemic such as COVID-19 does not solely consist of managing the virus but also social processes that impact its spread and eradication. Consequently, scholars have argued that, in addition to epidemiologists, social scientists should be consulted to effectively combat this pandemic (Van Bavel et al., 2020).

Despite the proposed impact of COVID-19 misinformation, there is a lack of knowledge about the extent to which different media sources play a role in how people form conspiracy beliefs. Prior research has primarily focused on the role of social media in this respect (e.g., Su, 2021). However, conspiracy theories are also increasingly discussed in mainstream (digital) media, which might offer an alternative route to get acquainted with and start believing such theories.

Furthermore, much of the earlier research is cross-sectional, which leaves open the question of directionality between media use and conspiracy beliefs. For both possible directions, some suggestive evidence can be found: Some researchers assume that deliberately misleading information and conspiracy theories diffuse broadly across social media users (Vosoughi, Roy, & Aral, 2018), while others suggest that conspiracy theories tend to spread across communities of people that already adopt these theories, leading to so-called echo chambers (Metaxas & Finn, 2017; Uscinski, DeWitt, & Atkinson, 2018). So, the question of causality arises: Do certain media sources discourage or promote conspiracy beliefs, or do those who are more or less likely to believe in conspiracy theories seek information from different media sources?

In this article, we tackle these questions in a longitudinal study among a large and representative sample of the Dutch population, which are repeatedly asked about their media use and COVID-19 conspiracy beliefs.

Misinformation and Conspiracy Beliefs

Terms such as misinformation, conspiracies, conspiracy theories, conspiracy beliefs, and conspiracy thinking are often used interchangeably, while in fact these are different concepts (Douglas et al., 2019). Misinformation is an umbrella term that refers to narratives or claims that are unverified, not supported, or even counterargued and rejected by expert opinions, such as conspiracy theories (Nyhan & Reifler, 2010). While all conspiracy theories are misinformation, not all misinformation is necessarily a conspiracy theory (e.g., an honest mistake). Conspiracy theories are generally disseminated with conscious underlying intentions, such as stimulating a social movement or making sense of events that counter existing worldviews (Douglas et al., 2019). They often point at secret plots by a group of powerful individuals as the driving force behind significant social or political events in society (Aaronovitch, 2010). Conspiracy theories entail allegations of plotting, which may (not) be true, unlike conspiracies, which are secret plots that have been proven to exist (Keeley, 1999; Levy, 2007). Conspiracy beliefs refer to thoughts and feelings that a specific conspiracy theory is true (Douglas et al., 2019). Finally, a broader concept is conspiracy thinking, which refers to the idea that individuals who believe in one conspiracy theory tend to believe in other conspiracy theories too (e.g., Imhoff & Bruder, 2014).

COVID-19 Conspiracy Theories

Misinformation and conspiracy theories about COVID-19 are a global problem, and alarming numbers of people are exposed to them (e.g., the United States: 48%, Mitchell & Oliphant, 2020; the United Kingdom: 46%, Ofcom, 2020; see also Cha et al., 2021). In the Netherlands, more than 500 unverified claims spread by Twitter trolls were mentioned in more than 12,000 tweets by almost 4,000 individual Twitter accounts (Vermanen, 2020). Most COVID-19 conspiracy theories that circulate(d) were about miracle cures (e.g., use of [hydroxy]chloroquine or bleach), followed by origin stories (e.g., the virus escaped from a Wuhan lab, was a secret Chinese bioweapon, was created by Bill Gates, or was a result of 5G technology; Evanega, Lynas, Adams, & Smolenyak, 2020). These theories were not only disseminated by online trolls but also by prominent, powerful individuals, such as President Trump of the United States and President Bolsonaro of Brazil, and were frequently reported in mainstream media (Constine, 2020; Evanega et al., 2020). In the Netherlands, some political parties disseminated COVID-19 misinformation that questioned the necessity of preventive measures and vaccines to combat the pandemic, which according to the Dutch minister of health is worrying since it may fuel false beliefs about the pandemic that directly threaten public health (Klaassen & van Mersbergen, 2021).

COVID-19 conspiracy beliefs are detrimental to the effectiveness of governmental policies to combat the spread of the coronavirus as they have been related to lower perceived risk of COVID-19 (Krause, Freiling, Beets, & Brossard, 2020) and institutional trust (Banai, Banai, & Mikloušić, 2020; Pummerer et al., 2020). Moreover, conspiracy believers show lower adherence to preventive measures (Allington et al., 2020; Freeman et al., 2020; Pummerer et al., 2020; Romer & Jamieson, 2020) and more

vaccination hesitancy (Freeman et al., 2020; Romer & Jamieson, 2020). On top of that, COVID-19 conspiracy beliefs may lead to increased political polarization (e.g., Allcott et al., 2020). Although many strategies have been developed over the years to counter the harmful impacts of conspiracy beliefs (e.g., debunking; Dentith, 2020), less attention has been paid to minimize the initial exposure to such claims. To that end, it is essential to know which specific media sources are involved in the dissemination of conspiracy theories.

Media Selection in the Current Media Landscape

Within the ongoing COVID-19 infodemic, the question arises about how individuals select particular media sources over others to seek information about the coronavirus. Importantly, the media landscape has been evolving so rapidly that the distinction between traditional, mainstream media (e.g., TV, newspapers, radio) and digital media (e.g., online news sites, social media) is fading. For instance, individuals increasingly read newspapers online (Wennekers, Huysmans, & de Haan, 2018), and traditional media sources have their own social media channels. The majority of online news consumption is accounted for by media consumers that visit the digital variant of their favorite mainstream media sources (Flaxman, Goel, & Rao, 2016). Additionally, the spread of information regarding COVID-19 was not limited to mainstream and social media sources. COVID-19 related information about the preventive measures, for example, was typically communicated via online health sources such as governmental websites (e.g., National Institute for Public Health and the Environment; Rijksinstituut voor Volksgezondheid en Milieu [RIVM] in the Netherlands). What makes the contemporary media landscape even more complex is that besides information communicated by authorities and journalists, the countless different social media platforms provide access to opinions and worldviews from virtually anyone in the world, and this can be impactful. To illustrate, research by the Center for Countering Digital Hate (2021) showed that just 12 individual social media users (i.e., the so-called Disinformation Dozen) were responsible for almost two-thirds of the anti-vaccine information circulating online.

In this extremely large reservoir of available information, individuals tend to scan media contents selectively to expose themselves primarily to information that aligns with their beliefs or needs (e.g., reinforcement theory, Atkin, 1973; or confirmation bias, Nickerson, 1998) though some media sources seem to be more inviting for this than others. The confirmation bias—the selection of information that aligns with one's worldview or beliefs over information that counters that—for example, has been found to be especially prevalent in online digital media and less so in printed, offline media (Pearson & Knobloch-Westerwick, 2019). Presumably, this is due to the way in which media sources present information to their audiences. That is, the underlying machine-learning algorithms of digital media are designed to personalize content to users' preferences and previous information consumption. Contents that the user probably dislikes is automatically filtered out, creating a personal filter bubble (Pariser, 2011). This filtering process causes media users to be selectively exposed to content that aligns with their existing beliefs (Pariser, 2011). Put differently, individuals (unconsciously) live in their own digital "echo chamber," where their worldviews are echoed by the contents they encounter (Flaxman et al., 2016; Metaxas & Finn, 2017). Scholars have argued that such echo chambers are at least partially responsible for increased ideological polarization and conspiracy beliefs (e.g., Baumann, Lorenz-Spreen, Sokolov, &

Starnini, 2020). Though, it should be noted that strict homogeneous communication within echo chambers is rare (Guess, Nyhan, Lyons, & Reifler, 2018).

Conspiracy Beliefs and Media Use

Despite this clear pressure point of how digital media may promote conspiracy beliefs, its detrimental role is debated on (Douglas et al., 2019; Uscinski et al., 2018). Although social media are often considered the culprit of creating and disseminating misinformation and conspiracy theories, both for COVID-19 (e.g., Allington et al., 2020; Su, 2021) and in general (e.g., Allcott, Gentzkow, & Yu, 2019), traditional media also increasingly mention conspiracy theories (e.g., the QAnon movement, Wong, 2020), and both traditional and social media also disseminate correct or verified claims. Furthermore, one should distinguish between the dissemination and development of conspiracy theories. While the Internet allows conspiracy theories to spread quicker and to a larger audience, this does not mean that more conspiracy theories are being developed (Clarke, 2007; Uscinski et al., 2018). The Internet can serve as an effective debunking tool, as the countless Internet users can immediately refute conspiracy theories (Clarke, 2007). Moreover, conspiracy beliefs rarely travel beyond their own echo chamber, so their impact on the mass audience seems limited (Metaxas & Finn, 2017; Uscinski et al., 2018).

Despite these debates on the precise relationship between media use and conspiracy beliefs, this association with regard to COVID-19 related conspiracy theories is rarely scrutinized. Jamieson and Albarracin (2020) found that exposure to mainstream print and broadcast media was associated with more accurate beliefs about the coronavirus (e.g., about prevention and lethality of COVID-19 infections) and with fewer misinformation beliefs (see also Allington et al., 2020). In contrast, social media use was positively related to being misinformed (Allington et al., 2020; Jamieson & Albarracin, 2020).

Notably, these studies are correlational in nature and therefore do not directly corroborate the idea that social media are fueling conspiracy beliefs in society. Following the reinforcing spiral model (RSM; Slater, 2015), there are valid arguments for both (causal) directions. In particular, the RSM proposes that media use can both influence outcome variables—such as conspiracy beliefs—and be influenced by these same variables. According to Slater (2015), the process of media selection is dynamic and ongoing, which means that certain media content influences subsequent attitudes and beliefs, which in turn may influence future media selection. To illustrate, if someone encounters a Facebook post about COVID-19 being a biochemical weapon, their beliefs regarding the coronavirus might change (media selection → beliefs), and as a result, this individual may start following the Facebook page to receive future information via this source (beliefs → media selection). Importantly, media selection is heavily influenced by individual differences and social contexts (Slater, 2015), so the interaction between differential media use on the one hand and being susceptible to conspiracy beliefs on the other hand is not straightforward.

Present Study

This study aims to answer the following research question:

RQ1: What are the relationships between the use of different types of media sources and COVID-19 related conspiracy beliefs, and how do these change over time?

We contribute to the literature on these topics in four ways. First, given the complexity of contemporary media landscape, and specifically the communication of COVID-19 related information, this study highlights the unique impact that *different types* of media have on beliefs in COVID-19 conspiracy theories and vice versa. Hence, this study distinguishes four media sources (traditional media sources, online news sources, online health sources, and social media sources) to investigate their potentially differential relationship with people's conspiracy beliefs. Second, given the longitudinal (four-wave panel) design, we can move past earlier research that is largely cross-sectional, to get more nuanced insights into the reciprocal relationships between media use and conspiracy beliefs. Third, this study was conducted on a large Dutch population-based sample, which enhances the generalizability and strengthens the replicability of our results. Fourth, we use random intercept cross-lagged panel models (RI-CLPMs; Hamaker, Kuiper, & Grasman, 2015) to nuance our understanding of between- and within-person differences in media use and conspiracy beliefs. RI-CLPMs allow us to decompose longitudinal data into stable, between-person differences versus temporal, within-person dynamics. Hence, we can assess whether people who use certain media more than others have stronger conspiracy beliefs (and vice versa), which is captured in between-person differences. Furthermore, we can unravel whether people who use certain media more than they usually do also hold stronger conspiracy beliefs (and vice versa), which is captured in the within-person differences. These distinctions help us to better understand whether media use and conspiracy beliefs are related because of differences *between* people in general or whether these are related because of *within*-person changes over time.

Methods

Sampling Procedure

Data were collected through CentERdata's Longitudinal Internet Studies for the Social Sciences (LISS) panel, consisting of 5,000 households in the Netherlands, comprising approximately 7,500 individuals. It represents a true probability sample of households drawn from the population register by Statistics Netherlands (LISSPANEL, n.d.). Selected households that cannot otherwise participate are provided with a computer and Internet connection. Panel members complete online questionnaires every month, for which they receive financial compensation. In addition, the LISS panel yearly collects data on sociodemographic variables and health status, among other core topics, which allows for researchers to add these to their survey data.

The data for our study were collected on four occasions. For the first wave, a random sample of 1,937 panel members were invited in the midst of the COVID-19 outbreak in May 2020. A total of 1,465 fully completed questionnaires (75.6%) were returned. These panel members were invited to complete the second-wave questionnaire in June 2020 (response rate: 92.3%, n = 1,352), followed by two more waves in July 2020 (response rate: 90.4%, n = 1,222) and October 2020 (response rate: 95.4%, n = 1,166). Time intervals of one month were applied between the first three waves to capture people's media use and misinformation beliefs during the rapid change of preventive measures in the Netherlands (May: first

lockdown; June: regaining some freedom with reopening of high schools, cultural sector, and hospitality sector; July: increased infection rates across Europe, debates on obligation to wear face masks), with a two-month break jumping to the second lockdown in October. Respondents who completed all four questionnaires comprised the sample for data analysis (N = 1,166).

Measures

Media Use

People indicated how often, in an average week in the past month, they used 15 types of media sources to receive information about COVID-19. Media sources included traditional media sources (news, current affairs programs and talk shows on television, newspapers, magazines, radio), online news sources (websites or apps of television news or newspapers, other news websites), online health sources (health websites or apps, government websites), and social media (social networking sites and chat programs). Respondents rated their media use on a scale from one to seven days a week, with the additional option to answer "never." We considered use of (a) traditional media sources, (b) online news sources, (c) health-related sources, and (d) social media sources as first-order factors, and media use as second-order factor. The descriptive statistics of these variables are provided in Tables A1 and A2, and the zero-order correlations and scatterplots of the media use subscales across time as well as the density plots for the subscales for each wave are visualized in Figure A1 of the online supplementary material (OSM).[2] Confirmatory factor analysis (CFA) showed adequate model fit of this four-dimensional structure across four waves:[3] χ^2 (1673) = 6063.67, p < .001, comparative fit index (*CFI*) = .895, Tucker-Lewis index (*TLI*) = .888, root mean square error of approximation (*RMSEA*) = .047, standardized root mean square residual (*SRMR*) = .101. Four media use subscales were computed based on mean scores for each wave.

Conspiracy Beliefs

We measured respondents' belief in conspiracy theories about COVID-19 with three conspiracy statements per wave (see Table B1 of the OSM).[4] These were rated on a scale ranging from 1 "certainly not true" to 5 "certainly true." The statements represented various conspiracy theories about the outbreak, spread, and potential treatment of the novel coronavirus and were similar to those used in previous research to assess misinformation beliefs (e.g., Čavojová, Šrol, & Ballová Mikušková, 2020). CFA showed adequate

[2]The OSM can be accessed via: https://osf.io/kjtdz/?view_only=d937b5cd61ed464b9e302bb8e6013b36

[3]To test for measurement invariance of media use across the four waves, we compared the configural model (i.e., factor loadings, intercepts, and latent means are able to differ across the four waves) with the strong model (i.e., factor loadings and intercepts are constrained across the four waves). The difference between the configural and strong model is significant, indicating that the four waves have different loadings and intercept structures. Hence, results of the strong model are reported here.

[4]For each wave, we presented respondents with 10 statements about COVID-19, of which three were conspiracy-related statements. Exploratory factor analysis showed that these three items loaded well on one component (factor loadings > .45). The current analyses are based on those conspiracy-statements. An overview of all 40 statements can be found in Appendix B, Table B3 in the OSM.

model fit across four waves:[5] χ^2 (48) = 222.14, $p < .001$, *CFI* = .948, *TLI* = .928, *RMSEA* = .056, *SRMR* = .036. Following earlier research (e.g., Čavojová et al., 2020), we calculated a mean score for the three statements for each wave.

Sociodemographic Variables

We extracted the following sociodemographic variables from the LISS Core questionnaire: age, gender, and education level. Education level was based on the categories used by CBS Statistics Netherlands (n.d.): Primary education, prevocational secondary education (VMBO), senior general secondary education (HAVO), pre-university education (VWO), senior secondary vocational education (MBO), higher vocational education (HBO), and university education (WO).

Statistical Analysis

The analyses were conducted with R (Version 3.6.1), using packages such as *lavaan* (Version 0.6-3; Rosseel, Jorgensen, & Rockwood, 2020) and *ggplot2* (Version 3.2.0; Wickham et al., 2020). To test the reciprocal relationship between media use and conspiracy beliefs, we used RI-CLPMs (Hamaker et al., 2015). The RI-CLPM is an extension of the cross-lagged panel model, which not only accounts for temporal stability but also for trait-like, time-invariant stability through the inclusion of a random intercept (i.e., a factor with all loadings constrained to one). The random intercept allows to distinguish variance at the within-level from variance at the between-level, which means that relationships between variables of interest pertain to within-person dynamics rather than between-person differences (Hamaker et al., 2015).

We performed four separate RI-CLPMs to test relationships between the four subcategories of media use (i.e., traditional media sources, online news sources, online health sources, and social media) and conspiracy beliefs. Mean scales of media use subcategories and conspiracy beliefs were calculated before running the RI-CLPMs. As we tested the same model four times, we corrected for potential alpha inflation due to multiple testing (i.e., Bonferroni correction) and considered all our findings significant at (α / k = 0.05 / 4) $p < .0125$. We followed the approach of Hamaker and colleagues (2015) according to which we specified the stable *between* components and the fluctuating *within* components. For the *between* components, two random intercepts (one for media use and one for conspiracy beliefs) with factor loadings constrained to one were included to represent the stable, time-invariant differences between individuals with regard to media use and conspiracy beliefs. The correlation between these random intercepts demonstrates the association between stable between-person differences in media use and stable between-person differences in conspiracy beliefs. For the *within* components, eight variables were defined to represent the differences between a unit's observed measurements and the unit's expected score based on the grand means and its random intercepts. In our model, these represent the within components of media use and conspiracy beliefs, respectively. Furthermore, lagged regression

[5]As the three conspiracy statements differed per wave, our latent construct of conspiracy beliefs was per definition measurement variant. As we cannot establish measurement invariance, we reported the results of the configural model (i.e., factor loadings, intercepts, and latent means are able to differ across the four waves) here.

were estimated, with auto-regressive paths reflecting within-person changes (or stability) over time in media use and conspiracy beliefs, respectively, and cross-lagged paths reflecting the extent to which media use and conspiracy beliefs are linked reciprocally, based on whether changes from an individual's expected score on media use (or conspiracy beliefs) are predicted from preceding deviations on conspiracy beliefs (or media use) and are an average of the within-person changes. A conceptual depiction of the RI-CLPMs for this study is shown in Figure 1.

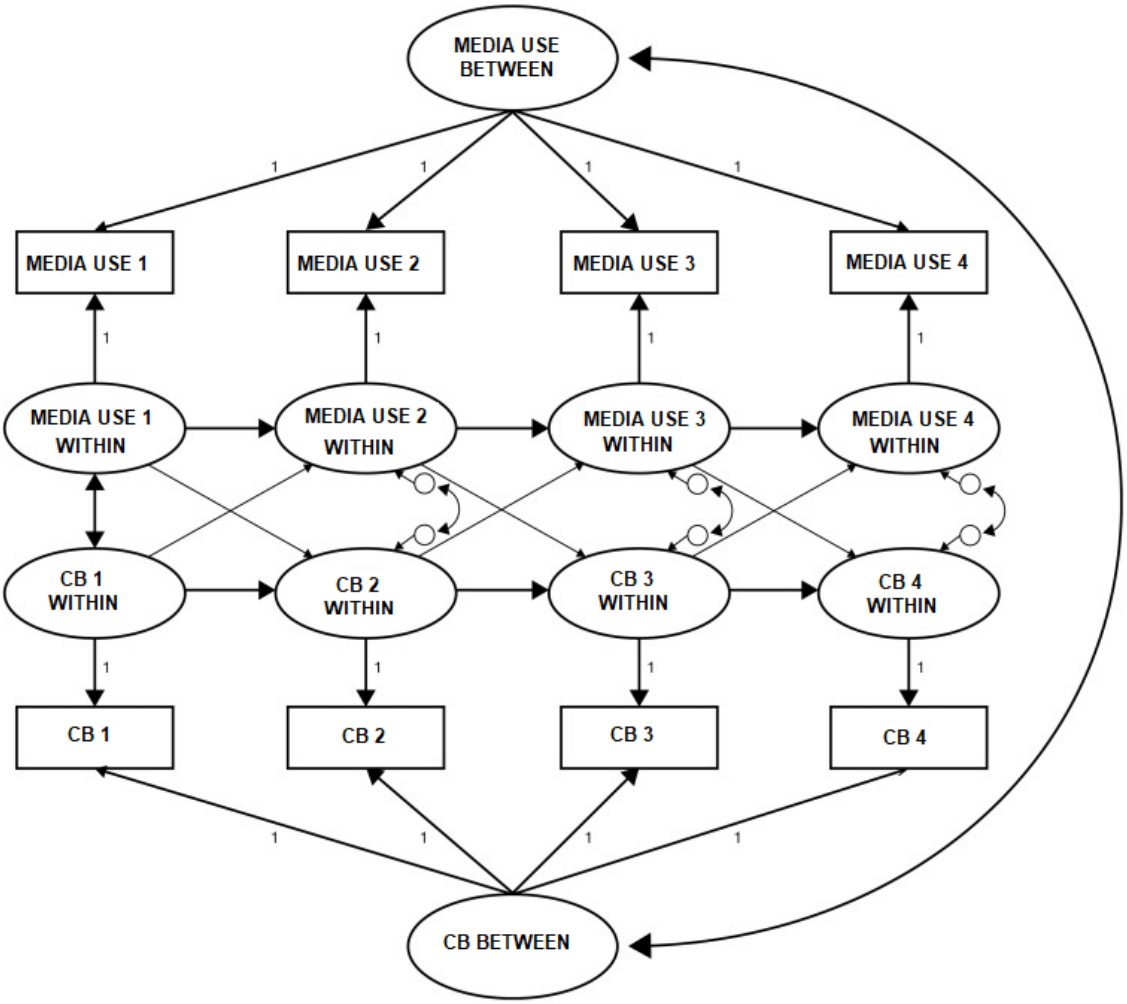

Figure 1. RI-CLPM of the relationship between media use and conspiracy beliefs across four waves.[6]

Note. CB = conspiracy beliefs.

[6]Media use was categorized in four subcategories of media sources. As a result, we ran four RI-CLPMs for each media use subcategory.

Results

Sample Characteristics

Respondents in our sample were on average 56 years old (M = 55.62, SD = 17.32, *range* = 18–103), and 50.3% were female (n = 586). About 28% completed a lower education level (primary education or VMBO), 34% a middle education level (HAVO, VWO, or MBO), and 38% completed a higher education level (HBO or WO). Overall, this sample was mostly representative of the Dutch population.[7]

With regard to COVID-19, most respondents (May: 93.1%; June: 93.4%; July: 91.9%; October: 88.2%) believed that they had not been infected with the virus. Although a slight increase of reported COVID-19 infections by our sample was found in October, only a small minority had been tested positive for COVID-19 in May (0.3%), June (0.1%), July (0.2%), and October (1.0%). Respondents also indicated more frequently in October about knowing people who had been diagnosed with the coronavirus compared with earlier months: In May, June, and July, about 28% reported knowing others who had been infected with the virus (May: 28.1%; June: 28.0%; July: 27.8%), whereas in October, 38.8% knew someone who had been infected with the virus.

Across the waves, 0.1%–3.4% of our sample was certain that the selected conspiracy theories were true, with an additional 1.2%–13.7% of our sample who thought it was likely that these were true (though this group comprised different individuals in each wave; for an overview per statement see Table B2 in the OSM). TV news was the most used media source (May: 94.3%; June: 91.9%; July: 90.4%; October: 92.4%) and apps such as health apps were the least used media source (May: 14.7%; June: 13.2%; July: 12.6%; October: 10.6%). For more detailed information, see Table A2 in the OSM.

Model Testing

The model that looked at relationships between media use of traditional media sources and conspiracy beliefs revealed adequate fit: χ^2 (9) = 81.03, p < .001, *CFI* = .984, *TLI* = .951, *RMSEA* = .083, *SRMR* = .041. The results (see Table 1) revealed several effects at the within-person level. Auto-regressive paths indicated statistically significant relationships over time in terms of conspiracy beliefs. Individuals with relatively high conspiracy beliefs (relative to an individual's own mean) in May (wave 1) were more likely to have more conspiracy beliefs in June (wave 2; β = .22, SE = .04, p < .001). However, individuals with relatively high conspiracy beliefs in July (wave 3) were more likely to have less conspiracy beliefs in October (wave 4; β = −.14, SE = .06, p = .008). For media use, no significant relations were found over time, which means that receiving COVID-19 information relatively frequently via traditional media sources (relative to an individual's own mean) on one occasion did not lead to also receiving COVID-19 information relatively frequently via traditional media sources on another occasion. No significant cross-lagged effects of media use on conspiracy beliefs were found, or vice versa, indicating that receiving more COVID-19 information from traditional media sources did not contribute to more conspiracy beliefs (e.g., waves 3–4: β = −.05, SE

[7]Our sample was slightly older than the mean age of the Dutch population (StatLine, 2020): M_{dif} = 6.17, 95% confidence interval (*CI*) [5.17, 7.16], t(1165) = 12.16, p < .001.

= .03, p = .330), and having more conspiracy beliefs did not lead to receiving more COVID-19 information via traditional media sources (e.g., waves 3–4: β = −.02, *SE* = .10, p = .793). Furthermore, results showed no significant between-person correlation, no significant cross-sectional association at wave 1 nor correlated change at waves 2–4.

The model for online news media use also showed adequate fit: χ^2 (9) = 74.23, p < .001, *CFI* = .983, *TLI* = .947, *RMSEA* = .079, *SRMR* = .040. Similar to traditional media use, results (see Table 1) showed statistically significant auto-regressive effects over time for conspiracy beliefs. These represented similar patterns as described above.[8] For media use, receiving COVID-19 information relatively frequently via online news media sources (relative to an individual's own mean) at a certain point in time did not lead to also receiving COVID-19 information relatively frequently via online news media sources at a later point in time. No significant cross-lagged effects of media use on conspiracy beliefs were found, or vice versa, indicating that receiving more COVID-19 information from online news media sources did not contribute to more conspiracy beliefs (e.g., waves 3–4: β = −.07, *SE* = .03, p = .210), and having more conspiracy beliefs did not lead to receiving more COVID-19 information via online news media sources (e.g., waves 3–4: β = .01, *SE* = .14, p = .864). Results further showed no significant between-person correlation, no significant cross-sectional association at wave 1 nor correlated change at waves 2–4.

With regard to online health sources, the model showed adequate fit: χ^2 (9) = 89.72, p < .001, *CFI* = .967, *TLI* = .896, *RMSEA* = .088, *SRMR* = .044. The results again showed statistically significant auto-regressive effects for conspiracy beliefs, which showed again similar patterns (for details, see Table 1). For media use, receiving COVID-19 information relatively frequently via online health sources (relative to an individual's own mean) at an earlier point in time did not lead to significantly receiving COVID-19 information relatively more or less frequently via online health sources at a later point in time. No significant cross-lagged effects of media use on conspiracy beliefs were found, or vice versa, indicating that receiving more COVID-19 information from online health sources did not contribute to more conspiracy beliefs (e.g., waves 3–4: β = −.04, *SE* = .03, p = .453), and having more conspiracy beliefs did not lead to receiving more COVID-19 information via online news media sources (e.g., waves 3–4: β = −.02, *SE* = .10, p = .724). Results further showed no significant cross-sectional association at wave 1, nor correlated change at waves 2–4. At the between-person level, we found a moderate correlation between media use and conspiracy beliefs (β = .27, *SE* = .02, p < .001). This suggests that people with relatively frequent use of health-related sources also reported relatively high levels of conspiracy beliefs compared with the group average.

For our final model in which we looked at the relationship between social media use and conspiracy beliefs, results showed adequate model fit: χ^2 (9) = 72.69, p < .001, *CFI* = .981, *TLI* = .940, *RMSEA* = .078, *SRMR* = .042. Statistically significant auto-regressive effects in this model indicated stability in social media use and conspiracy beliefs over time. For media use, receiving COVID-19 information relatively frequently via social media sources (relative to an individual's own mean) in May (wave 1) led to also receiving COVID-19 information relatively frequently via social media sources in

[8]The auto-regressive paths between conspiracy beliefs over time are similar across the four RI-CLPMs. Therefore, these results are not repeated in-text. Precise estimates can be found in Table 1.

June (wave 2: β = .15, *SE* = .05, p = .005). Similar patterns for conspiracy beliefs over time were found as described above (for details, see Table 1). With regard to cross-lagged effects, we found no significant effects of media use on conspiracy beliefs, or vice versa: Receiving more COVID-19 information from social media sources did not contribute to more conspiracy beliefs (e.g., waves 3–4: β = .03, *SE* = .02, p = .556), and having more conspiracy beliefs did not lead to receiving more COVID-19 information via social media sources (e.g., waves 3–4: β = .00, *SE* = .17, p = .952). We also found no significant cross-sectional association at wave 1, nor correlated change at waves 2–4. At the between-person level, social media use and conspiracy beliefs correlated moderately (β = .25, *SE* = .04, p < .001), indicating that people with relatively frequent use of social media sources also reported relatively high levels of conspiracy beliefs compared with the group mean.

Table 1. Standardized Estimates of the RI-CLPMs Regarding the Relationships Between Media Use and Conspiracy Beliefs Across Four Waves Specified for Four Types of Media Use (N = 1,166).

	Traditional Media			Online News		
	β	*SE*	*p*	*β*	*SE*	*p*
Auto-regressive paths						
Media use w1 → Media use w2	.06	.06	.324	.12	.05	.025
Media use w2 → Media use w3	.13	.07	.021	−.01	.06	.939
Media use w3 → Media use w4	.04	.06	.527	−.07	.08	.329
Conspiracy beliefs w1 → Conspiracy beliefs w2	.22	.04	.000	.22	.04	.000
Conspiracy beliefs w2 → Conspiracy beliefs w3	.02	.05	.665	.02	.05	.742
Conspiracy beliefs w3 → Conspiracy beliefs w4	−.14	.06	.008	−.15	.06	.006
Cross-lagged paths						
Media use w1 → Conspiracy beliefs w2	.08	.03	.118	−.03	.02	.447
Media use w2 → Conspiracy beliefs w3	−.05	.03	.384	−.01	.02	.803
Media use w3 → Conspiracy beliefs w4	−.05	.03	.330	−.07	.03	.210
Conspiracy beliefs w1 → Media use w2	−.07	.07	.124	−.05	.08	.258
Conspiracy beliefs w2 → Media use w3	.03	.09	.625	−.01	.12	.859
Conspiracy beliefs w3 → Media use w4	−.02	.10	.793	.01	.14	.864
Additional correlations						
Correlation w1	−.01	.02	.874	−.01	.03	.816
Residual correlation w2	.01	.02	.902	−.05	.02	.269
Residual correlation w3	.03	.02	.625	.04	.03	.514
Residual correlation w4	.02	.02	.682	−.01	.03	.922
Between-person correlation	−.04	.03	.291	−.03	.03	.397
	Health Sources			Social Media		
	β	*SE*	*p*	*β*	*SE*	*p*
Auto-regressive paths						
Media use w1 → Media use w2	.14	.07	.065	.15	.05	.005
Media use w2 → Media use w3	.07	.08	.345	.10	.06	.123
Media use w3 → Media use w4	−.17	.08	.028	−.09	.08	.244

Conspiracy beliefs w1 → Conspiracy beliefs w2	.22	.04	.000	.21	.04	.000
Conspiracy beliefs w2 → Conspiracy beliefs w3	.02	.05	.726	.03	.05	.613
Conspiracy beliefs w3 → Conspiracy beliefs w4	−.15	.06	.005	−.14	.06	.008
Cross-lagged paths						
Media use w1 → Conspiracy beliefs w2	.02	.02	.613	−.04	.01	.302
Media use w2 → Conspiracy beliefs w3	.01	.03	.841	.01	.02	.891
Media use w3 → Conspiracy beliefs w4	−.04	.03	.453	.03	.02	.556
Conspiracy beliefs w1 → Media use w2	.03	.06	.424	−.04	.10	.272
Conspiracy beliefs w2 → Media use w3	.08	.09	.141	−.02	.14	.760
Conspiracy beliefs w3 → Media use w4	−.02	.10	.724	.00	.17	.952
Additional correlations						
Correlation w1	−.01	.02	.923	.03	.04	.520
Residual correlation w2	.03	.02	.592	−.02	.03	.586
Residual correlation w3	−.01	.02	.827	−.00	.04	.949
Residual correlation w4	.03	.03	.648	.09	.04	.076
Between-person correlation	.27	.02	.000	.25	.04	.000

Note. All results but the between-person correlation reflect correlations at the within-person level. Results are considered significant at $p < .0125$ to correct for potential alpha inflation due to multiple testing.

Discussion

This study expanded extant literature by adopting a longitudinal design to investigate changes in media use and conspiracy beliefs over time during the COVID-19 pandemic, in a large, representative Dutch sample. Using RI-CLPMs, we identified how the use of specific media sources related to COVID-19 conspiracy beliefs, and how these relationships changed over time. Our results indicated that at group level the use of online health sources and social media were related to beliefs in COVID-19 conspiracies, such that more frequent use of these media sources was correlated with higher levels of conspiracy beliefs. However, the relationship between media use and conspiracy beliefs at the within-person level was not corroborated. Put differently, within individuals, using certain media sources to gather information about COVID-19 did not lead to changes in conspiracy beliefs over time, nor did beliefs in conspiracy theories lead to changes within individuals using specific media sources. As such, our results suggest that the relationship between media use and belief in conspiracy theories is more complicated than our model can show.

Theoretical Implications

Our findings have three important implications for theory. First, the use of RI-CLPMs provided evidence for the correlational association between the use of online health sources and social media on the one hand and conspiracy beliefs on the other, where more frequent use of these media sources was related to stronger conspiracy beliefs. This seems in line with earlier correlational research where the use of digital media sources (e.g., social media), has been associated with conspiracy beliefs (Allington et al., 2020). As the between-person effects in our study represent the averaged measurements across four waves, we were able to add more robust evidence for the positive relationship between use of certain types of media sources and conspiracy beliefs. Despite the group-level associations between media use and conspiracy beliefs, we

were not able to detect within-person effects, for which several explanations could be noted. For instance, the distribution of effect sizes varied as a function of time (Dormann & Griffin, 2015), and perhaps significant effects could be detected at smaller time intervals, such as two-week intervals. In addition, it could be that within-person effects do exist, but that these were very small and could not be detected with the current sample size, due to low statistical power. Nonetheless, given the large sample size and the full coverage of the media use and conspiracy beliefs scales, we believe this is unlikely and that alternative, theoretical explanations should be considered. The reciprocal relationships between media use and conspiracy beliefs may therefore not be as straightforward as previously assumed (Allington et al., 2020; Jamieson & Albarracin, 2020).

Second, the lack of causal effects at the within-person level might point at underlying processes to these relationships at an individual level that hinder the revelation of any causal effects. These findings corroborate the differential susceptibility to media effects model (DSMM: Valkenburg & Peter, 2013), which poses that individual differences cause differential use and effects of media. Such differential use and impact of media might have led to aggregated null effects between media use and conspiracy beliefs as for some individuals these relationships may be positive, for some negative, and for some stable over time. In turn, when making the link to the reinforcing spirals model (RSM; Slater, 2015), for some people their beliefs may be mainly affected by the media they consume, while for others their beliefs mainly determine their media selection and consumption. Consequently, relations between media use and beliefs as proposed by the RSM are not per definition uni- or bidirectional but may be unique per individual, and this should be elaborated on in future work.

Third and finally, our models showed that conspiracy beliefs were unstable over time, and that the statements per wave were believed by small numbers of people (0.1%–3.4% who were certain the selected conspiracy theories were true, and an additional 1.2%–13.7% of the sample who thought it was likely that these were true). This may suggest that conspiracy beliefs are personal, and individuals do not necessarily "fall" for the same theories, which is in contrast with previous work that suggests the existence of a "conspiracy mindset" (Imhoff & Bruder, 2014). Our findings reveal the possibility that conspiracy beliefs are in fact unstable as a construct as individuals over time move from having stable conspiracy beliefs (within individuals, higher conspiracy beliefs in May were associated with higher conspiracy beliefs in June), to having changing conspiracy beliefs (within individuals, higher conspiracy beliefs in June were not associated with higher conspiracy beliefs in July), to having contrasting conspiracy beliefs (within individuals, higher conspiracy beliefs in July were associated with lower conspiracy beliefs in October). Nonetheless, since only a small proportion of the sample believed in conspiracy theories, we cannot make strong claims about the possible nonexistence of a conspiracy mindset. Future research could employ different sampling strategies to target conspiracy thinkers to better understand how media use shapes their beliefs, and how conspiracy beliefs shape their media use.

Limitations and Future Research Directions

Although we contributed to prior research by investigating various types of media sources over time, we did not gather any data on the specific content about the coronavirus that respondents encountered via these media sources. However, the content gathered from different social media sources can vary a

great deal. For example, Twitter posts of *The New York Times* presumably contain very different content from the memes disseminated by friends via Facebook. Future research may therefore look into different types of media use in more detail, for example, by analyzing media headlines or deeper content.

Furthermore, the role of media credibility in people's media use and conspiracy beliefs was not considered. If an extensive social media user recognizes that information to be found there might not be credible, they may be less likely to believe conspiracy theories unlike someone with similar screen times who considers social media to be a credible source. Ignoring these unique individual differences in perceived media credibility may lead to aggregated null effects or very small effect sizes (see DSMM; Valkenburg & Peter, 2013). Indeed, research has shown that conspiracy beliefs depended on trust in social media news (Xiao, Borah, & Su, 2021). Hence, future research could investigate the influence of perceived media credibility for each media source type to get a better understanding of the interplay between media use and conspiracy beliefs.

Similarly, the role of variables such as age, educational level, health literacy, anxiety, and perceived control on an individual level could be scrutinized as these are found to predict believing COVID-19 conspiracies (e.g., Duplaga, 2020; Šrol, Mikušková, & Cavojova, 2021). It is essential to get more insights into specific subgroups of the population that are more or less susceptible to fake news and developing conspiracy beliefs. This may potentially pave the way for better and tailored intervention strategies to combat the ongoing infodemic.

Conclusion

This study investigated the reciprocal relationships between the use of different media sources (i.e., traditional media, online news, online health-related, and social media sources) for receiving information about COVID-19 and COVID-19 related conspiracy beliefs over time in a representative Dutch sample. Although we found that media use and conspiracy beliefs were related at the group level, the analysis of four RI-CLPMs revealed that there were no cross-lagged, within-person effects between media use and conspiracy beliefs, which means that the use of certain media sources to stay informed about COVID-19 did not cause changes in COVID-19 conspiracy beliefs, and believing COVID-19 conspiracy theories did not lead to the use of specific media sources. These findings suggest that the relationships between media use and conspiracy beliefs may be more complex than previously thought.

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