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Epistemically Suspect Beliefs About COVID-19: Results From a Population Survey in Finland

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ABSTRACT

We examined the familiarity and popularity of epistemically suspect COVID-19 claims and their associations with cognitive, social, and demographic factors in a sample of people living in Finland ($N = 1077$) during the pandemic (September 2021–January 2022). Endorsement of these claims was associated with pseudoscientific beliefs, less actively open-minded thinking, and preference for anecdotal information. Among social factors, lower trust in governmental institutions, science, and scientists, and reliance on alternative media were linked to higher endorsement. Regarding demographic variables, higher education was associated with lower endorsement, though this effect was fully mediated by cognitive and social factors. Men endorsed epistemically suspect COVID-19 claims more than women, and endorsement decreased with age. These findings highlight the importance of education in fostering critical thinking skills and trust in institutions and science to effectively combat health-related misinformation.

1 | Introduction

Societal crisis events such as public health threats, natural disasters, and war are fertile grounds for misinformation and conspiracy theories (van Prooijen and Douglas 2017). During the COVID-19 pandemic, misinformation and conspiracy theories about the deliberate development, release, or spread of the virus, and the suspected motives behind these deliberate actions, quickly gained traction on different social media platforms and news outlets (Cinelli et al. 2020). For example, in a survey conducted in 2020, 71% of Americans reported that they had heard a claim that the coronavirus outbreak was intentionally planned by powerful people (Mitchell et al. 2020). Thirty-six percent of those who had heard of this claim said that it is either definitely or probably true (see also Uscinski et al. 2022). In another survey (YouGov 2022), 19% of Americans said that it is either definitely or probably true that the U.S. government is using the COVID-19 vaccine to microchip the population (see also Uscinski et al. 2022).

The problem with the spread of COVID-19 misinformation and conspiracy theories is that they are related to poorer adherence to the safety guidelines meant to slow down the spread of the virus (e.g., Freeman et al. 2022; Roozenbeek et al. 2020; van Prooijen et al. 2022, 2023). Understanding what contributes to the susceptibility to misinformation and conspiracy theories is important when considering ways to mitigate their potentially adverse effects. In the present study, we examined how different cognitive, social, and demographic factors (van Mulukom et al. 2022) contribute to the endorsement of COVID-19 misinformation and conspiracy theories in a representative population sample of Finnish adults.

Finland is an interesting context for examining these effects, as Finns have relatively high trust in science and scientists, governmental institutions, and traditional media (Media-alan tutkimussäätiö 2022; Tieteen tiedotus ry 2022). During the pandemic, the Finnish government introduced several policies and recommendations to limit the spread and transmission of the virus, including school closures, restrictions for public gatherings, and recommendations for distance work (see Tiirinki et al. 2020). In the global context, these measures were aligned with other European countries but were not among the most stringent (Hale et al. 2021). Moreover, Finns have high trust toward the public educational system (Välimaa 2021), and education is free from the elementary school to university level. Finnish adults score very high in large-scale global skill assessments such as PIAAC, showing that the public educational system is also effective (OECD 2024). Understanding how different cognitive, social, and demographic factors are associated with the endorsement of epistemically suspect claims about COVID-19 within the Finnish context provides valuable information on the potential societal and cultural effects on the endorsement of misinformation.

1.1 | Epistemically Suspect Beliefs: Misinformation and Conspiracy Theories About COVID-19

Misinformation refers to inaccurate information that has been created and/or spread without the intention to cause harm. For example, the claim that the corona vaccine may cause infertility or erectile dysfunction reflects a worry that the vaccine is harmful, and while the claim itself is inaccurate, it may have been created and shared with the good intention of protecting others from its adverse effects. A conspiracy theory, by contrast, refers to a belief that some important events are caused by malevolent actors who have coordinated in secret to gain benefit, and that this is not widely known by the public (see Douglas and Sutton 2023). For example, the claim that Bill Gates developed the coronavirus to gain financial benefit is a conspiracy theory. However, there is an overlap between these terms, as this claim can also be regarded as misinformation because it offers an inaccurate account of the origins of the virus.

In the present study, we use the term "epistemically suspect claims" when referring to conspiracy theories or other types of misinformation about COVID-19. What is common to the epistemically suspect beliefs about COVID-19 is that they seem to stem from the need to question the official account of events. Previous research shows that believing in one conspiracy theory increases the likelihood of believing other conspiracy theories (e.g., Goertzel 1994). This has been taken as an indication of a monological belief system, where a belief in one conspiracy theory serves as evidence for another conspiracy theory (e.g., Goertzel 1994; Williams et al. 2022). In other words, if someone becomes suspicious about the official information about COVID-19, they are more likely to adopt other beliefs that seem to be supported by the initial suspicions (see Frenken and Imhoff 2021; Miller 2020).

A substantial body of research has examined individual differences in how prone people are to adopt epistemically suspect beliefs about COVID-19 (see van Mulukom et al. 2022). A recent review (van Mulukom et al. 2022) identified three types of antecedents of conspiracy beliefs about COVID-19: cognitive factors, social factors, and individual differences. First, cognitive factors such as other epistemically suspect beliefs, thinking styles, cognitive biases, and negative attitudes toward science have been linked to conspiratorial thinking in general, but also in connection to COVID-19. Second, social factors, such as the need to maintain group identity, lack of trust in authorities, and social media use seem to predict susceptibility to COVID-19 conspiracy beliefs. Third, individual differences in coping with threat and uncertainty, personality traits, and demographic variables like education have been identified as predictors of COVID-19 conspiracy beliefs. In the present study, we examined how different variables representing the three antecedents identified by van Mulukom et al. (2022) contribute to epistemically suspect beliefs about COVID-19.

1.2 | Cognitive Factors and Epistemically Suspect Beliefs

Cognitive factors such as other epistemically suspect beliefs, thinking styles, and cognitive biases have been linked to conspiratorial thinking in general, but also in connection to COVID-19 (van Mulukom et al. 2022). Previous research shows that when someone believes in a conspiracy theory, they are more likely to hold also other epistemically suspect beliefs (Bensley et al. 2020; Lobato et al. 2014; Stasielowicz 2022). Specifically, *pseudoscientific beliefs* have been associated with both general and specific conspiracy beliefs (Šrol et al. 2021; Stasielowicz 2022). Considering pseudoscientific beliefs is thus relevant when examining epistemically suspect beliefs about COVID-19.

Actively open-minded thinking refers to a disposition to approach information that contradicts one's prior beliefs with an open mind and readiness to reconsider prior opinions (Rizeq et al. 2021; Stanovich and West 1997). Individuals who are actively open-minded thinkers are less likely to hold pseudoscientific beliefs or show anti-science attitudes (Rizeq et al. 2021). Interestingly, lower actively open-minded thinking has been linked with higher endorsement of contradictory conspiracy theories (Petrović and Žeželj 2022), such as simultaneous beliefs that COVID-19 is a hoax and that it was purposefully created and spread. Actively open-minded thinking thus seems to protect against forming a conspiratorial mindset, and it may play a role in how likely an individual is to support general and specific conspiracy theories. However, some studies have failed to find a direct relationship between actively open-minded thinking and conspiracy beliefs (e.g., Rizeq et al. 2021). In the present study, we examined whether actively open-minded thinking is associated with the endorsement of epistemically suspect claims about COVID-19.

While actively open-minded thinking may reduce epistemically suspect beliefs, a tendency to rely on anecdotal information may increase the likelihood of accepting epistemically suspect claims. Intuitive thinking is associated with a tendency to be simultaneously skeptical about known facts but open to alternative facts (Newman, Lewandowsky, and Mayo 2022). Moreover, people who endorse conspiracy theories have been shown to rely less on

analytical thinking and more on intuitive thinking styles (Barron et al. 2018; Gligorić et al. 2021; Juanchich et al. 2021; Ståhl and van Prooijen 2018; Swami et al. 2014) and to rely less on scientific reasoning (Čavojová et al. 2020). Considering these findings, it seems plausible that individuals who are likely to hold epistemically suspect beliefs would generally prefer anecdotal testimonies over official statistical reports. A recent study by Mäki et al. (2023) supports this, as they found that the more conspiracy-minded people were, the more they preferred anecdotal testimonies to statistical data. Preferences for anecdotal or statistical health information could, therefore, also be relevant when investigating epistemically suspect beliefs about COVID-19.

1.3 | Social Factors and Epistemically Suspect Beliefs

Social factors, such as the need to maintain group identity, lack of trust in authorities, and social media use seem to predict susceptibility to COVID-19 conspiracy beliefs (van Mulukom et al. 2022). Many epistemically suspect claims about COVID-19 reflect distrust in governmental institutions and health officials: for example, the claim that COVID-19 is a conspiracy to take away citizens' rights for good and establish an authoritarian government reflects deep distrust in the government. Previous research shows that distrust in institutions is a crucial factor in conspiratorial thinking (e.g., Jennings et al. 2021), and there is a link between distrust in government officials and COVID-19 conspiracy beliefs (e.g., Pavela Banai et al. 2022). A generally distrusting mindset has also been associated with the tendency to simultaneously discredit known facts and accept alternative facts, indicating potential gullibility to misinformation (Newman, Lewandowsky, and Mayo 2022). Thus, it can be expected that the lack of trust in authorities is associated with endorsing epistemically suspect claims about COVID-19.

Some of the epistemically suspect claims about COVID-19 challenge the generally accepted scientific explanation of its origin, cause, or recommended prevention measures. Some conspiracy theories directly assume that scientists have played a crucial role in the pandemic, like the claim that the virus is a bioweapon developed by scientists (Sternisko et al. 2021). Previous research suggests that the lack of trust toward science and scientists is linked with conspiratorial thinking and science rejection (Rutjen and Većkalov 2022), indicating that individuals who have low trust in science and scientists may assume that scientists, as members of the elite, collude to purposefully mislead or control the public. In line with this view, distrust in science and scientists and negative attitudes toward science have been found to be significant predictors of epistemically suspect beliefs about COVID-19 (Roozenbeek et al. 2020; Tsamakis et al. 2022).

Trust and the use of social and alternative media seem to predict the tendency to endorse conspiracy theories (e.g., Schemer et al. 2022), and more specifically, misinformation (e.g., Ahmed and Rasul 2022; Roozenbeek et al. 2020) and conspiracy theories about the COVID-19 pandemic (e.g., Allen et al. 2023; Hetzel et al. 2022; Xiao et al. 2021; Ziegele et al. 2022). Research suggests that the reliance on social and alternative media sources increases the acceptance of epistemically suspect claims (Allington et al. 2021; de Coninck et al. 2021; Hetzel et al. 2022; Roozenbeek et al. 2020; Tsamakis et al. 2022; Xiao et al. 2021; Ziegele et al. 2022), whereas the use of journalistic media for news decreases susceptibility to epistemically suspect beliefs (Allen et al. 2023; de Coninck et al. 2021; Hetzel et al. 2022; but see Ziegele et al. 2022). Using longitudinal data, Romer and Jamieson (2021) showed that the constant use of social media platforms with false or misleading content was associated with increased COVID-19 conspiracy beliefs across time, whereas the use of traditional and mainstream media sources for news protected against conspiracy beliefs. Moreover, changes in conspiracy beliefs associated with media use predicted mask-wearing and vaccination intentions, showing that media use has an important role in shaping people's beliefs and, thus, compliance with official recommendations.

1.4 | Demographic Differences in Epistemically Suspect Beliefs

Individual differences in coping with threat and uncertainty, personality traits, and demographic variables are related to the endorsement of conspiracy theories about COVID-19 (van Mulukom et al. 2022). Previous results on the associations between sociodemographic factors—such as age and gender—and endorsement of COVID-19 conspiracy theories are mixed (see van Mulukom et al. 2022). In some studies, younger people were more likely to believe in COVID-19 conspiracy theories, whereas in others, older people were more likely to endorse them (see van Mulukom et al. 2022, for a review). Regarding gender, some studies report that women are more likely to accept conspiracy claims about COVID-19, whereas others have found that conspiracy theories are more popular among men (van Mulukom et al. 2022).

The results concerning education seem to be more robust, as COVID-19 conspiracy theories are typically more popular among those with lower levels of education (van Mulukom et al. 2022). It has been suggested that education has indirect effects on conspiracy beliefs through different cognitive and social variables (van Prooijen 2017; Ballová Mikušková 2023). van Prooijen (2017) examined mediators between education and general conspiracy beliefs and found that feelings of powerlessness or control and analytic thinking mediated the effect of education on conspiracy beliefs. Extending the study of van Prooijen (2017) to COVID-19 conspiracy beliefs, Ballová Mikušková (2023) found indirect effects of education through feelings of control and scientific reasoning. These findings suggest that the various positive effects associated with education, like better analytic thinking skills and increased feelings of control, decrease the susceptibility to conspiracy beliefs. However, these prior studies have examined only a restricted set of variables, leaving open the question of whether education has indirect effects via other social or cognitive variables associated with epistemically suspect beliefs. A better understanding of the mediating factors between education and epistemically suspect COVID-19 beliefs would help in specifying how education could curb the spread of misinformation.

As suggested by van Mulukom et al. (2022), the conflicting results regarding the associations between demographic variables and conspiracy beliefs might reflect the complex interplay between psychological and social factors (see also van Prooijen 2017). In the present study, we examined the associations between different cognitive, social, and demographic factors and the

endorsement of epistemically suspect claims about COVID-19. We focused on the potential indirect effects of education and extended the previous studies (Ballová Mikušková 2023; van Prooijen 2017) by examining a variety of potential cognitive and social mediators between education and COVID-19 beliefs.

1.5 | Aims and Research Questions

Since the start of the pandemic, beliefs about COVID-19 have been examined around the world, and the research suggests that the popularity of misinformation and conspiracy theories varies between countries (e.g., Roozenbeek et al. 2020; Sternisko et al. 2021, 2023; Uscinski et al. 2022; van Prooijen et al. 2022). For example, the relatively popular claim in the US about the coronavirus (COVID-19) vaccine being used to implant a microchip received very little support in a Dutch survey (van Prooijen et al. 2022). Even though previous studies have examined the popularity and endorsement of COVID-19 misinformation and conspiracy theories across different countries (e.g., Roozenbeek et al. 2020; Sternisko et al. 2021), many have focused only on a few belief statements and/or used convenience samples. The present study used a wide variety of epistemically suspect claims about COVID-19 to gain a better understanding of what kind of epistemically suspect claims were familiar and popular at the time of the pandemic. Moreover, we aimed at collecting a representative population sample to examine the endorsement of COVID-19 misinformation and associated factors among the Finnish population. To ensure a representative Finnish sample, participants were recruited from the national population register using mail-based invitations, which allowed us to avoid the limitations of convenience sampling.

Another limitation of previous studies is that they often have examined only a few factors that could be related to epistemically suspect beliefs, and only some studies have tested the unique contribution of different factors when multiple factors are considered simultaneously. In the present study, we examined multiple cognitive, social, and demographic factors and their associations with epistemically suspect COVID-19 beliefs. In particular, we tested whether different social and cognitive variables mediate the effect of education on such beliefs.

The research questions were the following:

1. What were some of the most familiar and popular epistemically suspect claims about COVID-19 in Finland during the pandemic?
2. Which cognitive, social, and demographic factors predict the endorsement of epistemically suspect claims about COVID-19 in a population sample?

2 | Methods

2.1 | Participants

A random sample ($N = 5000$) of 18–75-year-old persons living in mainland Finland was contacted to participate in the survey. The sample was provided by the Digital and Population Data Services Agency (the Finnish Digital Agency), and it was representative of the Finnish population in terms of age, gender, and geographical distribution. By January 3, 2022, 1126 participants (22.5%) had answered the survey.

The demographic data reported in this paper is based on the participants' self-reported information. The mean age of the participants was 51.45 years (SD 16.58). Of the participants, 550 (51.1%) identified as women, 503 (46.7%) as men, 9 (0.8%) as non-binary, and 15 (1.4%) did not report their gender. As for home language, 90.0% reported Finnish, with other major languages being Swedish (5.4%) and English (2.3%). Russian, Estonian, German, Persian, Vietnamese, Arabic, Chinese, or Turkish were reported in total by 1.7%. Finally, 0.6% reported their home language as some other, less frequently spoken language. The majority of participants were born in Finland (93.0%) and reported that their parents were also born in Finland (92.5% of mothers, 92.7% of fathers). As for education, 8.6% had completed basic or primary education (elementary or grade school), 10.5% had graduated from a secondary school (baccalaureate), 27.9% had a vocational or professional training degree, 26.3% had a bachelor's degree, 24.1% had a master's or higher degree, and 1.8% reported "none of the above/no formal education." Most of the participants were currently working (employed 43.6%, self-employed 7.1%) or retired (29.6%). As for the households, most participants were married or cohabiting (21.6% with children living at home, 44.7% without children). The mode of income was 2500–3499€ per month.

2.2 | Belief Survey

The data reported here originates from a survey study, which examined beliefs and attitudes toward science. The survey included items on different types of epistemically suspect beliefs and several other scales. In this study, we report the results regarding COVID-19 misinformation and conspiracy beliefs, pseudoscientific beliefs, use of media, trust in institutions, trust in science and scientists, actively open-minded thinking, and preference for anecdotal information. The English version of the full survey questionnaire, including the scales not reported here, is available in the Open Science Framework (https://osf.io/9k3b5/). All scales included in the present study and the rationale for selecting items to be included in the analyses presented here are provided in Appendix 1.

2.2.1 | COVID-19 Beliefs

Items related to COVID-19 beliefs were created based on conspiracy and pseudoscience discussions in different social media outlets popular in Finland. The scale contained 17 items (e.g., "The virus causing the corona disease (COVID-19) was deliberately released from a Chinese laboratory."), tapping into different themes related to the deliberate development, release, or spread of the virus, and beliefs about corona vaccines. For each item, participants first stated whether they had heard the claim before (1 = yes, 0 = no). Then, they marked on a seven-point Likert scale how much they agreed with the claim (1 = completely disagree, 7 = completely agree). The internal consistency coefficient Cronbach's alpha for the COVID-19 belief items was 0.92.

2.2.2 | Pseudoscientific Beliefs

The pseudoscientific belief items (e.g., "Telepathy is a real phenomenon, although it has not been scientifically verified.") were taken from a survey on supernatural beliefs (four items; Ervasti 2006) and from discussions on popular social media platforms (six items). For each item, participants first indicated whether they had heard the claim before, and then marked on a seven-point Likert scale how much they agreed with it (1 = completely disagree, 7 = completely agree). Cronbach's alpha for pseudoscientific belief items was 0.86.

2.2.3 | Media Use

Participants were queried about their frequency of engagement with specific media outlets and online services, encompassing both traditional (e.g., television and newspapers; five items) and digital media platforms (e.g., news media websites, mobile applications, social media, discussion forums; eight items) (Matikainen et al. 2020). The participants answered on a six-point scale how often they used the media (1 = not at all, 2 = very rarely, 3 = once a month, 4 = every week, 5 = every day, 6 = several times a day). Cronbach's alphas were 0.71 for traditional media and 0.79 for digital media use. Use of alternative and counter media had a low item-total correlation with other items in the digital media scale and it was treated as a separate variable in the subsequent analyses. As it was extremely skewed, we created a dichotomous variable where 1 = once a month or more often and 0 = not at all or very rarely.

2.2.4 | Trust in Institutions

Trust in institutions was measured by asking participants "How much do you trust the following institutions or actors in society?" (e.g., parliament, health care system; Metelinen 2021). Participants evaluated 10 items on a five-point Likert scale (1 = fully distrust, 5 = trust a lot) with a response option "I don't know". Cronbach's alpha was 0.85.

2.2.5 | Trust in Science and Scientists

Trust in science and scientists was measured by four items from the Trust in Science and Scientists Inventory (Nadelson et al. 2014). The statements probed topics such as "Scientists ignore evidence that contradicts their work". The participants responded to the statements on a five-point scale (1 = completely disagree, 5 = completely agree). Three items were reverse-coded so that higher sum scores reflect higher trust. Cronbach's alpha was 0.69.

2.2.6 | Actively Open-Minded Thinking

The short form of the Actively Open-Minded Thinking scale (Haran et al. 2013; Svedholm-Häkkinen and Lindeman 2018) includes seven statements such as "A mature person changes their mind if presented with better arguments for an opposing opinion." Participants answered how much they agreed with the statements on a five-point scale (1 = completely disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, 5 = completely agree). Four items were worded in the opposite direction and reverse coded so that higher values indicate more actively open-minded thinking. Cronbach's alpha was 0.77.

2.2.7 | Anecdotal Preference

The Format Preference Scale (Mäki et al. 2023) includes six statements such as "When I make decisions related to my health, I usually base them on available statistical information" and "People's personal experiences have a big impact on my health decisions". The participants responded to the statements on a seven-point Likert scale (1 = completely disagree, 7 = completely agree). Two items were reverse-coded so that higher scores indicated a stronger preference for anecdotal information. One item was deleted to improve internal consistency; Cronbach's alpha for the five items was 0.88.

2.2.8 | Background Information

The background information included questions about gender, age, postal code, home language, education, current occupation, income, whether the participant was born in Finland, and whether the participant's parents were born in Finland.

2.3 | Procedure

The study was approved by the Ethics Committee for Human Sciences of the University of Turku and followed the Declaration of Helsinki. The first batch of questionnaires was mailed in September 2021. Reminder letters to those who had not answered by the first week of October were sent in October 2021. Participants received the materials in their native language as indicated by the Population Information System data if it was Finnish, Swedish, or English. If their native language was something else, the participants received the materials in English. Participants could respond to the questionnaire either on paper or via the internet; 859 participants (76.3%) answered on paper and 267 (23.7%) responded to the online questionnaire on the Webropol survey platform.

Participants had a chance to participate in a draw of four gift certificates (á 50€) to retail stores.

2.3.1 | Data Pre-Processing

Four responses did not contain correct ID codes used to identify responders, and these cases were excluded from the data. Careless responding was identified in two steps. First, we checked whether the participant had responded to at least 11 of the 17 COVID-19 belief items, and 17 participants were excluded based on this criterion (1.51% of the data). Second, there were two control statements with the same content but opposite wording ("People will be unwillingly microchipped along with coronavirus vaccinations." and "There are no microchips

in corona vaccines."). Thirty-two participants failed to respond similarly to the control questions, and their data were removed from the analysis (2.89%). The final sample used in the analyses was $N = 1077$.

Because there were very few participants who reported their gender as other than male or female ($n = 9$), gender was converted to a dummy-coded variable (1 = female, 0 = male), and "other" as well as missing responses were excluded from the statistical models. Education level was coded on a scale from one to five, one denoting the basic level of education and five a master's or higher degree. Education level was recoded as missing if the reported education level was "other".

2.3.2 | Statistical Analyses

Confirmatory factor analyses (CFAs) were conducted on all measures to confirm the expected factor structures before proceeding with the main analyses (see Appendix 2).

To address the research questions, we conducted linear regression and mediation analyses. Linear regression was conducted in two steps. In the first step, we fitted a regression model predicting COVID-19 beliefs with demographic variables (gender, age, and education level) (Model 1). In the second step, cognitive variables (pseudoscientific beliefs, actively open-minded thinking, and anecdotal preference) and social variables (trust in institutions, trust in science and scientists, and media use) were added as predictors (Model 2).

Mediation analyses were conducted to examine the indirect effects of education on COVID-19 beliefs via social and cognitive factors. Standardized path coefficients were estimated using maximum likelihood estimation (ML). Indirect effects were estimated using percentile bootstrap confidence intervals based on 5000 resamples.

We verified the normality and homoscedasticity assumptions for the regression models by visually inspecting the residual plots and other residual diagnostics including Cook's distance and large studentized residuals. Based on these diagnostics, we found eight cases that displayed a potentially excessive influence on the regression model. The removal of these cases did not result in significant changes in the main findings or the overall explanatory power of the model, and we decided to keep these cases in the model. Multicollinearity was assessed by variance inflation factors (VIF). All VIFs < 2.10, indicating that the predictor variables were not highly correlated. The percentage of missing values in our sample was $< 1\%$ ($n = 41$). The patterns of missing data were assessed and determined to be completely at random. Accordingly, listwise deletion was used to handle missing data.

All analyses were conducted using the R statistical software (v4.3.0; R Core Team 2023). Data preprocessing was performed using functions from the *tidyverse* (Wickham et al. 2019), regression models were standardized using *lm.beta* (Behrendt 2023), and structural equation modeling and mediation were carried out using the *lavaan* package (Rosseel 2012). The data and analysis code are available via OSF (https://osf.io/9k3b5/).

3 | Results

3.1 | Description of the Sample Characteristics

We first examined whether the final sample corresponded with the population sample ($N = 5000$) by comparing the distributions of the background variables (gender, age, home language, and geographical region) between the samples. The descriptive statistics of the background variables in the final sample are presented in Table 1. The distributions of gender ($\chi^2(1) = 0.66$, $p = 0.416$) and geographical region ($\chi^2(17) = 14.15$, $p = 0.561$) did not differ between the final sample and the population sample. However, there were differences in age ($\chi^2(12) = 86.51$, $p < 0.001$) and home language ($\chi^2(1) = 12.92$, $p < 0.001$), indicating that the sample slightly overrepresented older age groups (> 65 years) and Finnish speakers.

3.2 | Familiarity and Popularity of Epistemically Suspect COVID-19 Claims

Table 2 presents the descriptive statistics of the familiarity and endorsement of the COVID-19 belief items. Some of the most familiar claims were that the virus was deliberately developed (78% of the participants responded they were familiar with this claim) and released from a Chinese laboratory (86%). Eighty-one percent of the participants had also heard the claim that corona vaccines are used to microchip people, and 72% had heard the claim that corona vaccines are harmful and that this fact is being covered up. Furthermore, 70% of the participants reported they had heard the claim that the pandemic does not exist, and 65% that the news media have exaggerated the existence of the pandemic. Clearly less familiar were claims about presidents of different countries who conspire against citizens (13%), and that ethylene oxide used in the corona swabs can cause cancer (9%).

TABLE 1 | Descriptive statistics of the background variables ($N = 1077$).

Variable	M	SD
Age	51.45	16.56
	N	**%**
Gender		
Man	503	46.70
Woman	550	51.10
Non-binary	9	0.80
Missing	15	1.40
Education		
Basic	93	8.60
Vocational	301	27.90
Secondary	113	10.50
Bachelor	283	26.30
Master's/PhD	260	24.10
Missing	27	2.50

TABLE 2 | Familiarity and endorsement of different COVID-19 claims.

Items	Familiarity[a]		Endorsement[b]				
	N	%	*N*	M	SD	Mdn	%
1. 5G networks spread the coronavirus.	918	62.53	1064	1.22	0.69	1	0.94
2. The authorities have deliberately exaggerated the number of people who have died from the coronavirus.	918	53.38	1066	1.92	1.43	1	8.72
3. Ethylene oxide, commonly used to sterilize coronavirus sampling sticks, can cause cancer.	797	9.28	1056	2.57	1.46	2	4.36
4. The virus that causes the corona disease (COVID-19) was deliberately released from a Chinese laboratory.	853	86.17	1058	2.83	1.60	2	17.20
5. With corona vaccines, people are implanted with a microchip against their will.	829	81.06	1071	1.27	0.74	1	0.75
6. Corona-vaccinated people spread the spike proteins of the coronavirus around themselves.	813	27.68	1069	1.90	1.25	1	2.81
7. The corona pandemic is part of a global effort to force everyone to get vaccinated.	813	50.31	1068	1.77	1.33	1	6.46
8. Bill Gates has developed the coronavirus to profit from it.	813	26.94	1064	1.44	0.96	1	1.60
9. There really is no corona pandemic.	813	69.74	1073	1.37	0.95	1	2.52
10. The news media has exaggerated the existence of the corona pandemic.	813	65.31	1068	2.18	1.51	2	12.17
11. Corona vaccines do not have a microchip. (R)	792	59.09	1069	1.32	0.75	1	0.84
12. Corona vaccines can cause, e.g., infertility or erectile problems.	792	44.82	1070	2.60	1.47	2	8.04
13. The presidents of different countries are conspiring with each other to keep people at home in order to make decisions against the will of the voters.	792	13.13	1065	1.78	1.18	1	2.82
14. Someone is spreading the coronavirus on purpose.	792	45.33	1065	2.17	1.47	2	9.86
15. The coronavirus (SARS-CoV-2) was originally developed in a laboratory.	792	77.65	1061	3.41	1.67	4	24.03
16. The global elite is taking advantage of the corona pandemic to create a new totalitarian world government.	792	23.36	1069	2	1.35	1	5.24
17. The harmfulness of corona vaccines is covered up.	792	71.97	1069	2.51	1.59	2	14.59

Note: The table presents descriptive statistics for the 17 COVID-19 claims, each measured on a scale from 1 (completely disagree) to 7 (completely agree). (R) Reversed item.

[a]Familiarity indicates the percentage of participants who had heard the claim before.

[b]Endorsement indicates the mean, standard deviation, and median of the responses given on a scale from 1 to 7, and the percentage of participants who responded *"slightly agree," "agree,"* or *"completely agree"* to the item.

Looking at the percentages of participants who responded that they at least slightly agreed with the claims, 24% agreed with the claim that the coronavirus was originally developed in a laboratory, and 17% that it was deliberately released from a Chinese laboratory. About 15% agreed with the claim that the harmfulness of the corona vaccine is covered up, and 12% with the claim that the news media has exaggerated the existence of the corona pandemic. Other claims received little support, indicating that most participants either had no clear opinion or did not agree with them. For example, less than 1% of the respondents agreed with the claims regarding corona vaccines containing microchips or 5G networks spreading the coronavirus.

Overall, the endorsement of epistemically suspect COVID-19 claims was very low (medians ranged from 1 to 2 on a scale from 1 to 7). Looking at the means of the responses, the two most endorsed claims were that the virus was originally developed ($M = 3.42$, $SD = 1.67$) and deliberately released from a Chinese laboratory ($M = 2.83$, $SD = 1.60$). The third most endorsed claim was that corona vaccines can cause infertility or erectile dysfunction ($M = 2.59$, $SD = 1.47$). The fourth most endorsed claim regarded the potential harmful effects of the ethylene oxide used in the swab sticks ($M = 2.58$, $SD = 1.46$), and the fifth most endorsed claim was that the news media has exaggerated the existence of the corona pandemic ($M = 2.17$, $SD = 1.51$). The least endorsed claims were that 5G networks spread coronavirus ($M = 1.21$, $SD = 0.68$), people will be unwillingly microchipped with corona vaccination ($M = 1.27$, $SD = 0.74$), and that the coronavirus pandemic does not exist ($M = 1.37$, $SD = 0.95$).

3.3 | Factors Predicting Epistemically Suspect COVID-19 Beliefs

The descriptive statistics and correlations between variables used in the analyses are presented in Table 3. We first examined how demographic variables (age, gender, and education level) predicted epistemically suspect COVID-19 beliefs (Model 1; see Table 4). The model was significant, $F(3, 999) = 45.86$, $p < 0.001$, and explained 12% of the variance. Age and education were significant predictors, indicating that higher education and older age were associated with fewer epistemically suspect beliefs about COVID-19.

Next, cognitive and social variables were added to the model (Model 2; see Table 4). The model was significant, $F(11, 991) = 130.39$, $p < 0.001$, and explained an additional 47% of the variance, for a total of 59% of variance explained. All cognitive and social predictors, except for traditional and digital media use, showed statistically significant associations with epistemically suspect COVID-19 beliefs. Looking at the standardized regression coefficients (see Table 4), pseudoscientific beliefs emerged as the strongest predictor of epistemically suspect COVID-19 beliefs ($\beta = 0.55$), while trust in institutions ($\beta = -0.21$) and preference for anecdotal information ($\beta = 0.20$) were the next most important predictors. Although other predictors were statistically significant, their associations with COVID-19 beliefs were modest in magnitude.

Regarding demographic variables, the endorsement of epistemically suspect COVID-19 claims decreased with age, and after controlling for the cognitive and social variables in Model 2, women reported less epistemically suspect COVID-19 beliefs than men. Finally, the effect of education was not statistically significant in Model 2, suggesting that the association between education and COVID-19 beliefs observed in Model 1 may be mediated by the social and/or cognitive variables.

We then tested whether the effect of education on epistemically suspect COVID-19 beliefs was mediated by cognitive (actively open-minded thinking, anecdotal preference, and pseudoscientific beliefs) and social variables (trust in institutions, trust in science and scientists, traditional media use, digital media use, and alternative media use), while controlling for gender and age (see Table 5). The total effect of education on epistemically suspect COVID-19 beliefs was statistically significant ($\beta = -0.40$, 95% CI [−0.46, −0.33]). However, the direct effect was not ($\beta = -0.03$, 95% CI [−0.09, 0.02]), indicating full mediation.

Significant indirect effects of education were observed through multiple mediators (see Figure 1). As for cognitive factors, indirect effects were significant through actively open-minded thinking ($\beta = -0.03$, 95% CI [−0.05, −0.01]), anecdotal preference ($\beta = -0.06$, 95% CI [−0.08, −0.03]), and pseudoscientific beliefs ($\beta = -0.15$, 95% CI [−0.18, −0.12]). Of the social factors, the pathway through trust in institutions was significant ($\beta = -0.08$, 95% CI [−0.10, −0.06]), as was the pathway through trust in science and scientists ($\beta = -0.04$, 95% CI [−0.07, −0.02]). These findings indicate that education is associated with lower endorsement of epistemically suspect COVID-19 beliefs through its influence on thinking style, pseudoscientific beliefs, information preference (anecdotal vs. statistical), and trust in institutions and science. In contrast, the indirect effects through traditional media use ($\beta = 0.00$, 95% CI [0.00, 0.00]), digital media use ($\beta = -0.01$, 95% CI [−0.02, 0.01]), and alternative media use ($\beta = -0.01$, 95% CI [−0.02, 0.00]) were not significant, as the confidence intervals included zero.

4 | Discussion and Conclusions

The present study explored the familiarity and popularity of epistemically suspect claims about COVID-19 as well as demographic, cognitive, and social factors that predict beliefs in a representative population sample of people living in Finland during the pandemic.

4.1 | Familiarity and Popularity of Epistemically Suspect COVID-19 Claims

Even though the COVID-19 misinformation and conspiracy theories scoped in this study were familiar to the participants, the overall endorsement of them was very low. The results showed that the most popular epistemically suspect claims about COVID-19 were related to the deliberate development and release of the virus, which were also among the most familiar. While familiar claims may sound more plausible, these claims also touch upon the causes of the pandemic, which still are under debate. Their high endorsement rates may reflect that epistemically suspect claims, such as conspiracy theories, offer explanations for significant, inexplicable events and thus

TABLE 3 | Means, standard deviations, reliability coefficients, and intercorrelations of variables.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. COVID-19 beliefs	2.01	0.86	0.92											
2. Pseudoscientific beliefs	3.08	1.12	0.63	0.86										
3. Traditional media use	3.41	0.88	−0.05	0.13	0.71									
4. Digital media use	3.53	0.96	−0.12	−0.22	−0.32	0.79								
5. Alternative media use	1.03	0.16	0.18	0.09	0.05	0.04	—							
6. Trust in institutions	3.82	0.70	−0.52	−0.32	0.12	0.12	−0.12	0.85						
7. TSSI	3.61	0.70	−0.47	−0.44	−0.18	0.30	−0.10	0.42	0.69					
8. AOT	4.08	0.59	−0.45	−0.48	−0.12	0.24	−0.02	0.22	0.49	0.77				
9. Anecdotal preference	2.87	1.21	0.52	0.51	0.04	−0.18	0.04	−0.30	−0.45	−0.46	0.88			
10. Age	51.59	16.53	−0.01	0.23	0.50	−0.61	−0.02	−0.05	−0.31	−0.12	0.08	—		
11. Gender[a]	1.52	0.50	−0.02	0.10	−0.02	0.07	−0.08	0.12	0.04	−0.09	0.02	−0.06	—	
12. Education	3.29	1.35	−0.34	−0.33	−0.08	0.31	−0.06	0.28	0.39	0.36	−0.35	−0.16	0.09	—

Note: Cronbach's α on the diagonal.
Abbreviations: AOT = actively open-minded thinking, TSSI = trust in science and scientists.
[a]0 = man, 1 = woman.

TABLE 4 | Hierarchical regression analysis for variables predicting epistemically suspect COVID-19 beliefs.

Model	Predictor	*B*	SE	*β*	*t*	*p*	95% CI
Model 1	(Constant)	2.927	0.136		21.592	< 0.001	[2.66, 3.19]
	Age	−0.004	0.002	−1.512	−2.603	0.009	[−0.01, 0.00]
	Gender	0.014	0.051	0.005	0.269	0.788	[−0.09, 0.11]
	Education level	−0.224	0.019	−0.553	−11.679	< 0.001	[−0.26, −0.19]
Model 2	(Constant)	3.197	0.286		11.166	< 0.001	[2.64, 3.76]
	Age	−0.010	0.002	−3.560	−6.306	< 0.001	[−0.01, −0.01]
	Gender	−0.072	0.036	−0.024	−1.989	0.047	[−0.14, 0.00]
	Education level	−0.019	0.015	−0.046	−1.244	0.214	[−0.05, 0.01]
	Pseudoscientific beliefs	0.325	0.020	0.552	16.091	< 0.001	[0.28, 0.36]
	Anecdotal preference	0.101	0.018	0.200	5.529	< 0.001	[0.07, 0.14]
	Actively open-minded thinking	−0.103	0.038	−0.047	−2.704	0.007	[−0.18, −0.03]
	Trust in science and scientists	−0.135	0.034	−0.089	−3.965	< 0.001	[−0.20, −0.07]
	Trust in institutions	−0.316	0.030	−0.207	−10.702	< 0.001	[−0.37, −0.26]
	Traditional media use	−0.031	0.023	−0.033	−1.317	0.188	[−0.08, 0.02]
	Digital media use	−0.023	0.025	−0.028	−0.922	0.357	[−0.07, 0.03]
	Alternative media use	0.475	0.108	0.018	4.418	< 0.001	[0.26, 0.69]

Note: Gender was a binary variable where 0 = man and 1 = woman.

fulfill epistemic needs (e.g., van Prooijen and Douglas 2017). It is noteworthy that the claim about the coronavirus vaccine secretly containing a microchip was very familiar to our participants—81% had heard this before. However, it had an extremely low endorsement rate, indicating that high familiarity alone does not increase the endorsement of a claim.

Combined with the previous studies, the present results indicate that although misinformation and conspiracy theories spread globally, their endorsement may vary across countries (e.g., Roozenbeek et al. 2020; Sternisko et al. 2023; Uscinski et al. 2022; van Prooijen et al. 2022). For example, the claim about the coronavirus containing a microchip showed a very low endorsement rate in our sample, in line with data from the Netherlands (van Prooijen et al. 2022) but in contrast to the results reported in the USA (Uscinski et al. 2022; YouGov 2022). Previous national surveys show that Finns have relatively high trust in science and scientists, governmental institutions, and traditional media (Media-alan tutkimussäätiö, 2023; Tieteen tiedotus ry 2022). Trust in media increased during the COVID-19 pandemic in Finland: in 2020, 56% of Finns said they trusted most news, whereas in 2022 this number was 69% (Media-alan tutkimussäätiö 2022). These are high numbers compared to, for example, the United States, where only 26% said they trusted most news (Newman, Fletcher, et al. 2022). While several methodological factors may impact the comparability of the results across countries and studies, the present study suggests that socio-cultural differences such as trust in institutions, including media, may influence the popularity of misinformation.

4.2 | Cognitive and Social Factors Associated With Epistemically Suspect COVID-19 Beliefs

In addition to examining the familiarity and popularity of epistemically suspect claims regarding COVID-19, we were interested in the demographic, cognitive, and social factors that are associated with their endorsement. Of cognitive factors, pseudoscientific beliefs, actively open-minded thinking, and a preference for anecdotal information over statistical facts were all related to the endorsement of epistemically suspect claims about COVID-19. Participants who reported more pseudoscientific beliefs were also more likely to endorse epistemically suspect claims about COVID-19. These results support recent findings showing that epistemically suspect beliefs, like pseudoscientific beliefs, increase the likelihood of endorsing conspiracy theories (e.g., Šrol et al. 2021; Stasielowicz 2022). The finding that actively open-minded thinking was related to a lower endorsement of epistemically suspect claims is in line with research showing that thinking styles are associated with endorsing conspiracy theories (Petrović and Žeželj 2022; but see Rizeq et al. 2021). Also, the preference for anecdotal information over statistical facts when considering health-related information was associated with higher endorsement of epistemically suspect COVID-19 claims, in line with previous findings by Mäki et al. (2023).

As for the social factors, our results showed that lower trust in institutions and science and scientists predicted the endorsement of COVID-19 misinformation and conspiracy theories. These findings are in line with those of previous research showing that distrust in institutions (Newman, Lewandowsky,

TABLE 5 | Mediation model between education and epistemically suspect COVID-19 beliefs.

Effect	Path	β	SE	LL	UL	p
Direct effects	Education → COVID-19 beliefs	−0.03	0.03	−0.09	0.02	0.208
	Education → Trust in institutions	0.27	0.03	0.21	0.33	< 0.001
	Education → Trust in science and scientists	0.35	0.03	0.29	0.41	< 0.001
	Education → Actively open-minded thinking	0.36	0.03	0.31	0.41	< 0.001
	Education → Anecdotal preference	−0.35	0.03	−0.40	−0.29	< 0.001
	Education → Pseudoscientific beliefs	−0.31	0.03	−0.36	−0.25	< 0.001
	Education → Analog media use	0.01	0.03	−0.05	0.06	0.858
	Education → Digital media use	0.23	0.02	0.18	0.28	< 0.001
	Education → Alternative media use	−0.05	0.03	−0.11	0.01	0.072
	Trust in institutions → COVID-19 beliefs	−0.29	0.03	−0.36	−0.22	< 0.001
	Trust in science and scientists → COVID-19 beliefs	−0.12	0.04	−0.20	−0.05	0.001
	Actively open-minded thinking → COVID-19 beliefs	−0.08	0.03	−0.15	−0.01	0.018
	Anecdotal preference → COVID-19 beliefs	0.16	0.03	0.10	0.22	< 0.001
	Pseudoscientific beliefs → COVID-19 beliefs	0.48	0.03	0.42	0.54	< 0.001
	Analog media use → COVID-19 beliefs	−0.04	0.03	−0.10	0.03	0.249
	Digital media use → COVID-19 beliefs	−0.03	0.03	−0.09	0.03	0.349
	Alternative media use → COVID-19 beliefs	0.10	0.04	0.03	0.18	0.009
Indirect effects	Education → Trust in institutions → COVID-19 beliefs	−0.08	0.01	−0.10	−0.06	< 0.001
	Education → Trust in science and scientists → COVID-19 beliefs	−0.04	0.01	−0.07	−0.02	0.001
	Education → Actively open-minded thinking → COVID-19 beliefs	−0.03	0.01	−0.05	−0.01	0.021
	Education → Anecdotal preference → COVID-19 beliefs	−0.06	0.01	−0.08	−0.03	< 0.001
	Education → Pseudoscientific beliefs → COVID-19 beliefs	−0.15	0.02	−0.18	−0.12	< 0.001
	Education → Analog media use → COVID-19 beliefs	0.00	0.00	0.00	0.00	0.860
	Education → Digital media use → COVID-19 beliefs	−0.01	0.01	−0.02	0.01	0.349
	Education → Alternative media use → COVID-19 beliefs	−0.01	0.00	−0.02	0.00	0.155
Total effect	Education → COVID-19 beliefs	−0.40	0.03	−0.46	−0.33	< 0.001

Abbreviations: LL = lower limit of the 95% confidence interval, UL = upper limit of the 95% confidence interval.

and Mayo 2022; Jennings et al. 2021; Pavela Banai et al. 2022) and science and scientists (Roozenbeek et al. 2020; Tsamakis et al. 2022) is associated with epistemically suspect beliefs about COVID-19. Many COVID-19 conspiracy theories reflect the assumption that the governmental institutions or media plot against the citizens to gain control, or that the scientists have played a role in the development and release of the virus. If one has low trust in governmental actors and scientists, these claims probably seem more plausible.

Moreover, the use of alternative media was associated with the endorsement of epistemically suspect COVID-19 claims. Our findings align with recent research showing that the constant use of media platforms with false or misleading content is associated with increased endorsement of epistemically suspect claims (Allington et al. 2021; de Coninck et al. 2021; Hetzel et al. 2022; Romer and Jamieson 2021; Roozenbeek et al. 2020; Tsamakis et al. 2022; Xiao et al. 2021; Ziegele et al. 2022), whereas the use of traditional and mainstream media sources may protect against misinformation (Allen et al. 2023; de Coninck et al. 2021; Hetzel et al. 2022; Romer and Jamieson 2021). However, we did not find associations between digital or traditional media use and endorsement of epistemically suspect COVID-19 claims, reflecting that the quality of the content in the media is probably more important than whether the outlet is digital or not.

Of cognitive and social variables, pseudoscientific beliefs showed the strongest association with epistemically suspect COVID-19 beliefs, followed by trust in institutions and preference for anecdotal information. The strength of the other predictor variables was more modest. These findings indicate that when several predictors are considered simultaneously, pseudoscientific beliefs that often concern health-related information, trust in institutions that had a central role in the society

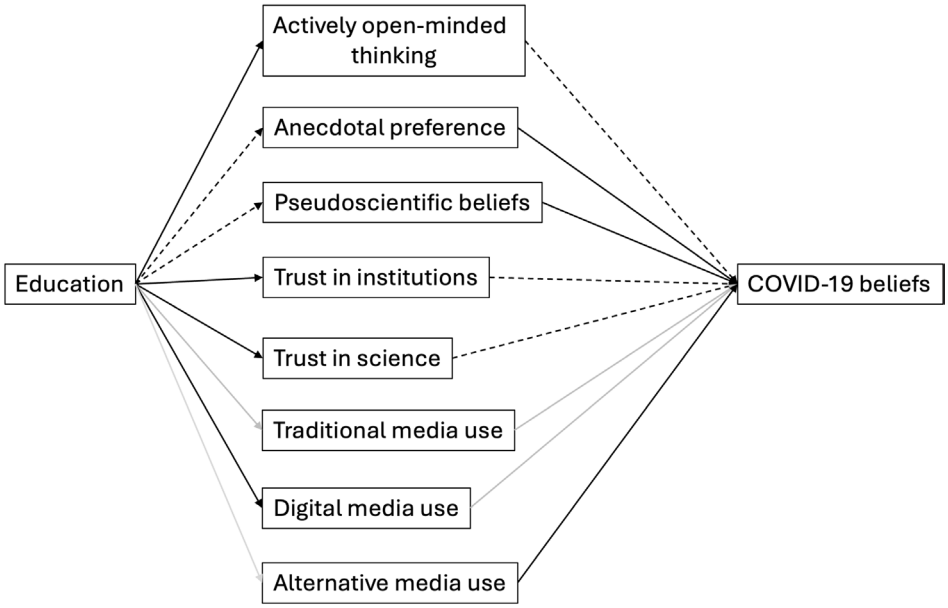

FIGURE 1 | Mediation model of education on epistemically suspect COVID-19 beliefs. Solid lines indicate statistically significant positive path coefficients, dashed lines represent significant negative coefficients, and grey lines denote non-significant paths.

during the pandemic, and preference for anecdotal information when making health-related decisions are stronger predictors of COVID-19 beliefs than more general factors like actively open-minded thinking style, trust in science in general, or alternative media use.

4.3 | Demographic Variables Associated With Epistemically Suspect COVID-19 Beliefs

As for the effects of demographic variables, gender and age were related to endorsing epistemically suspect claims about COVID-19. Men were more likely than women to endorse COVID-19 misinformation and conspiracy theories. However, the gender effect was small, and it was statistically significant only in the model where social and cognitive factors were included. Previous results on the effect of gender on COVID-19 conspiracy beliefs are mixed (van Mulukom et al. 2022), and our research adds to this previous literature by demonstrating that when various cognitive and social factors are considered, there seems to be a small gender difference in susceptibility to epistemically suspect beliefs about COVID-19.

Our results also showed that the endorsement of epistemically suspect claims about COVID-19 decreased with age. This finding aligns with the results of a recent meta-analysis (Bordeleau and Stockemer 2024) showing that age has a small but robust effect on conspiracy beliefs. While there are many potential explanations for the age effect (see Bordeleau and Stockemer 2024), our data suggest that one explanation for the age effect may be related to media use. We observed relatively high correlations between digital and traditional media use and age: older people are more likely to use traditional media, whereas younger adults prefer digital media outlets. As younger people are more likely to use digital media outlets where the COVID-19 misinformation and conspiracies may be prevalent, they may become more exposed to misinformation than older people, who mainly rely on traditional media.

Of particular interest here was the effect of education on epistemically suspect COVID-19 beliefs. Our results showed that the effect of education was fully mediated by cognitive and social factors. In addition to being more actively open-minded thinkers than individuals with lower levels of education, highly educated individuals also rely less on anecdotal information when making health-related decisions, hold fewer pseudoscientific beliefs, and exhibit greater trust in institutions, science, and scientists—factors that reduce the endorsement of epistemically suspect beliefs about COVID-19. Interestingly, there was no evidence for a mediation via media use, showing that the protective effect of education is not related to what kind of media is followed. Previous studies have systematically found that higher education protects from COVID-19 conspiracy beliefs (see van Mulukom et al. 2022), and the education effects on conspiracy beliefs have been linked to better analytic thinking skills and increased feelings of control (Ballová Mikušková 2023; van Prooijen 2017). The present study adds to this literature by suggesting that education has indirect effects on susceptibility to misinformation via various cognitive and social factors.

4.4 | Limitations

The present study investigated the associations between different cognitive, social, and demographic factors and epistemically suspect beliefs about COVID-19. While the present results suggest factors that may contribute to the susceptibility to adopting such beliefs, our data are correlational, so we cannot make strong claims about causal effects. However, the contribution of our study lies in its simultaneous assessment of several cognitive, social, and demographic factors, providing information about the unique role of each factor when controlling for the others. For example, although our results suggest that various cognitive factors may make people more susceptible to misinformation, social factors such as trust in institutions and science, as

well as media use, also play a role. Moreover, our results show that the effect of education is mediated by several cognitive and social factors.

Another limitation is that, despite including several different measures in our study, we may have missed some important factors that are associated with the endorsement of epistemically suspect COVID-19 claims. In addition to using longitudinal data, future studies should further examine potential moderating and mediating effects between different social and cognitive factors on the endorsement of misinformation and conspiracy theories.

Finally, these results were obtained in a sample of Finnish adults and may not generalize to other populations. Non-Finnish speakers and younger age groups were underrepresented in our sample. Finns generally show high trust in governmental institutions, media, and science and scientists (Media-alan tutkimussäätiö 2022; Tieteen tiedotus ry 2022). Even though several of the COVID-19 claims included in the present study were relatively familiar to the respondents, their overall endorsement was very low. Our results demonstrate that many cognitive, social, and demographic factors that have been found to be important in the endorsement of epistemically suspect claims about COVID-19 in previous studies (see van Mulukom et al. 2022) are also important in the Finnish social and cultural context. However, future studies should target younger age groups and language minorities to get a fully representative view of these effects.

4.5 | Conclusions

In summary, the present results show that various cognitive and social factors are associated with the endorsement of epistemically suspect COVID-19 claims. Pseudoscientific beliefs, low actively open-minded thinking style, and preference for anecdotal information seem to increase the likelihood of endorsing epistemically suspect claims about COVID-19. In addition, social factors, like low trust in institutions, science, and scientists increase susceptibility to misinformation and conspiracy beliefs about COVID-19. Moreover, exposure to alternative or counter media increases the endorsement of epistemically suspect claims. The effect of education on the endorsement of epistemically suspect COVID-19 claims was fully mediated by cognitive and social factors. These findings highlight the importance of education in fostering critical thinking skills and trust in institutions and science to effectively combat health-related misinformation.

Author Contributions

Johanna K. Kaakinen: conceptualization, funding acquisition, writing – original draft, methodology, supervision. **Ali Moazami Goodarzi:** writing – original draft, formal analysis, data curation, writing – review and editing. **Tuomo Häikiö:** conceptualization, writing – original draft, methodology, writing – review and editing, data curation. **Pasi Kivioja:** conceptualization, methodology, writing – review and editing. **Karl O. Mäki:** conceptualization, methodology, writing – review and editing. **Daria Pritup:** conceptualization, methodology, writing – review and editing, project administration.

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Ethics Statement

The study was approved by the Ethics Committee for Human Sciences of University of Turku and followed the Declaration of Helsinki.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The materials, data, and analysis code are available via Open Science Framework (https://osf.io/9k3b5/).

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Appendix 1:** acp70117-sup-0001-Appendix_1.docx **Appendix 2:** acp70117-sup-0002-Appendix_2.docx