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Cognitive authorities of COVID-19 information: educational differences and outcomes of trust in health experts and social media influencers in Finland

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Abstract

Introduction. This study investigates people's trust in institutional healthcare experts and social media influencers as sources of COVID-19 information. Using the notion of 'cognitive authority', this study examines trusted information sources during the pandemic, how the education level explains this trust, and how trusted COVID-19 information sources are associated with people's attitudes towards vaccines.

Method. Data were collected through eight rounds of nationally representative repeated cross-sectional surveys in 2021. The data set included 8507 respondents from Finland.

Analysis. A descriptive analysis was conducted to understand how trust evolved throughout the pandemic. Then, linear probability models were employed to analyse the factors shaping trust and determining vaccine intention. Finally, the analysis examined the indirect effects of trust in the association between education and vaccine uptake.

Results. Education explains trust in institutional experts or social media influencers: Those with lower education are more likely to trust social media influencers, and their trust in them is connected to negative attitudes towards vaccines.

Conclusion. The findings confirm that people rely on institutional experts and healthcare professionals during a health crisis. Our primary concern is the 5% who trust social media influencers and distrust health experts. The alternative information and low trust in institutions presented by social media influencers can disproportionately affect citizens with a lower level of education.

Introduction

The outbreak of the COVID-19 pandemic caused an unexpected and threatening situation that immediately triggered a need for reliable information. This shift prompted a surge in news consumption, predominantly from traditional outlets, as individuals sought accurate information and engaged in fact-checking (Altay et al., 2022; Nazione et al., 2021; Zhao and Tsang, 2022). The reliability of crisis information carries implications for public adherence to pandemic restrictions and vaccination campaigns (Guldin et al., 2021). As mistrust in legacy media can lead to non-compliance, understanding the information sources individuals rely upon is paramount (Lee, 2010). Confusion and anxiety prevailed in the early stages of the crisis, creating a chaotic information environment. The loss of control and feelings of uncertainty led to increased consumption of social media (Dow et al., 2021).

The increased consumption of information triggered by the pandemic had dual effects: it kept individuals informed and helped enhance self-efficacy while mitigating anxiety from the uncertain situation (Marzouki et al., 2021). The diversity of crisis information and media consumption positively influenced individuals' willingness to adopt proactive preventive measures (Chadwick et al., 2021; Zhao and Tsang, 2022; Koivula et al., 2023). However, the World Health Organization (WHO) expressed concerns about the 'infodemic': the widespread dissemination of misinformation on social media following the COVID-19 pandemic. The evolving understanding of COVID-19 made distinguishing misinformation from legitimate information an ongoing challenge, especially during the initial stages when information was scarce.

Social media platforms emerged as pivotal drivers of polarisation and conflicts surrounding pandemic policies, amplifying dissenting voices (Verbalyte and Eigmüller, 2022). Detecting reliable news amidst the deluge of content became a pressing concern. The quality of information, particularly regarding policies and treatments for COVID-19, significantly influenced public adherence to restrictions and vaccination efforts. Discrediting institutions through social media content exacerbated the challenges health authorities faced. Given the abundance of information sources, it is crucial to examine people's most trusted sources about COVID-19 and evaluate their influence on attitudes towards institutions and measures that were set during the pandemic. Moreover, trust has become a key element in the fight against pandemics, and several studies have highlighted its multi-dimensional role (e.g., Adhikari et al., 2022).

This study's main theoretical concept uses Patrick Wilson's (1983) notion of cognitive authority and suggests that especially at the beginning of the crisis, when the demand for reliable information was the highest, people turned to sources they considered the most trustworthy and relevant, meaning information from cognitive authorities. In today's high-choice media environment context, we compare people's trust in institutional and non-institutional information sources. By institutional information sources, we refer to information provided by educational, professional, or governmental actors. As a non-institutional source of COVID-19 information, we present social media influencers (SMIs): social media users who accumulate a large following by detailing their personal lives and lifestyles and monetise the attention by integrating commercial content into their social media content (Abidin, 2016, p. 3). During the pandemic, many sought new business opportunities and started producing content about COVID-19 to respond to the growing demand for information. Consequently, SMIs were publicly identified as key distributors of COVID-19 misinformation (e.g., Waterson, 2020).

This study offers novel insights into changes in trust under extraordinary conditions when accurate information is scarce. The research questions address whether social media influencers are considered authorities on COVID-19 information compared to institutional experts and whether people's trusted information sources influence their views on COVID-19 vaccines. Moreover, recognising the limited existing research on

how demographic factors affect trust in COVID-19 information, we incorporate the influence of education into our analysis and determine whether one's education level explains individuals' trust or distrust in institutional experts and SMIs and whether the relationship between trust and education is connected to views on vaccines.

Literature review

Trust and credibility in social media

Some individuals and instances have informational authority over others. The term cognitive authority refers to the authority and influence that someone or some sources have over one's thoughts (Wilson, 1983). Thus, cognitive authority is a relationship between people rather than an individual trait and relates to a particular sphere of interest (ibid., p. 14). According to Wilson, cognitive authority is closely related to credibility and has two main components: competence and trustworthiness. When people view a person or institution as a reliable information source, they believe in their competence in the topic in question (ibid., p. 15). The cognitive authority theory contains the idea that people develop their understanding of the world in two ways: based on their firsthand experience or in information beyond the range of their own experience—on what they have learned secondhand from others (ibid., p. 9–10). Most of this information is gained secondhand. As Wilson developed his theory before social media's existence, its relevance in a digital networked environment has remained unknown. In social media, traditional ways of determining authority are largely irrelevant. As it is associated with secondhand opinions rather than facts, social media is usually considered a less reliable source of information (Bonnici, 2016).

Unlike formal expertise, cognitive authority depends on social recognition (Wilson 1983, p. 13). Therefore, one can be considered an authority by some but challenged by others. Social media has brought one's personal preferences and judgements into the centre of information-seeking and evaluation. The information's perceived reliability increasingly depends on the person who shared the content. For example, if a social media friend is considered an opinion leader, the news they share is likelier to be deemed trustworthy (Turcotte et al., 2015). Assumedly, the relevance and trustworthiness of a news source are elevated in exceptional situations, such as the outbreak of the COVID-19 crisis, when people faced an unknown threat and coped with the rising stress by learning more about it (Marzouki et al., 2021). Moreover, time spent on online health sites and conversations about COVID-19 contributes to people's general efficacy and engagement in preventive action (Nazione et al., 2021). Therefore, during stress and uncertainty, people likely follow news and information from the sources they find the most trustworthy and credible; these sources influence their views, beliefs, and actions.

When seeking health-related information, people are not only interested in information from health authorities but tend to value secondhand information that provides laypeople's personal experiences. Although personal experiences on health matters are not cognitively authoritative by traditional standards, they can be affectively authoritative and help one cope with health problems emotionally (Neal and McKenzie, 2011). During the COVID-19 crisis, the demand for user-generated content was exceptionally high when institutionalised media and experts could not sufficiently provide accurate information (Cuello-Garcia et al., 2020; Chan et al., 2020), and people likely turned to opinion leaders who could provide affective and cognitive authority. Abidin and colleagues (2021) suggest that social media influencers were a vital information source, especially for younger audiences, during the social isolation and the initial stages of the pandemic. In some countries, including Finland, SMIs were invited to participate in COVID-19 campaigns in collaboration with health authorities and governments due to their opinion leader position and reach among audiences who are unlikely to follow health authorities (Abidin et al., 2021; Pöyry et al., 2022). However, as the pandemic progressed, some SMIs became major disseminators of misinformation and conspiracy theories about COVID-19 treatments and vaccines (Baker, 2022).

In accordance with social learning theory, following credible and trusted role models is associated with higher trust in government actions and the willingness to get vaccinated (Quinn et al., 2013). Some scholars have recommended using visible role models, such as SMIs, in public health communication (Andrews et al., 2020; Quinn et al., 2013). In marketing, research has shown these models' effectiveness in purchasing decisions, which is based on their interactive, long-term relationship with their audience rather than traditional source credibility standards (Leite and Baptista, 2022; Gupta et al., 2022). People have reported positive attitudes towards SMIs as a potential source of COVID-19 information (Gupta et al., 2022); however, no research exists on how public opinion viewed their trustworthiness as communicators about COVID-19 during the crisis.

Changing trust and media use during the COVID-19 crisis

Trust in social media influencers is linked to how trust in institutions changes during a crisis. A significant increase in trust in political institutions was observed across European countries after the outbreak of the COVID-19 pandemic (Esaiasson et al., 2021; Kritzinger et al., 2021; Kestilä-Kekkonen et al., 2022). However, this trust remained temporary and eroded over time while conflicting and protesting voices grew in the public debate (Verbalyte and Eigmüller, 2022). Similarly, research has detected an increase in trust in institutional news media, especially for those who considered news media an important source of information about the pandemic (Knudsen et al., 2023). According to a Reuters digital news report (Newman et al., 2020, 2021), trust in news media increased from 2020 to 2021 in almost all countries, contrary to the pre-pandemic trend of decreasing media trust. In Finland, people's news media consumption was more common than the EU average (Verbalyte and Eigmüller, 2022).

In addition to the growth in consumption and trust in institutional news media (Adam et al., 2023), people's social media usage significantly grew after the COVID-19 outbreak (Nabity-Grover et al., 2020). Despite this growth in use, the portion of those who mentioned social media as their primary source of information about the pandemic remained small (Verbalyte and Eigmuller, 2020). Furthermore, people reported health authorities and professionals being their most trusted information sources during the pandemic, whereas social media was trusted the least (Sabat et al., 2020). Research highlights that active participation in social media is associated with more sceptical attitudes towards political leaders, increased conspiracy theory thinking, and vaccine hesitancy (Verbalyte and Eigmüller, 2020; Melki et al., 2021; Rathje et al., 2022; Chadwick et al., 2021). Overall, social media has seemingly become a place where frustrated individuals express their anger and disappointment about the pandemic, and these individuals may be more susceptible to misinformation because they do not trust official news.

Educational differences in trust, information-seeking, and vaccine acceptance

In addition to defining cognitive authority and its consequences for compliance during crises, the role of education in this relationship interests us. We highlight education as a key explanatory factor because we acknowledge prior research findings showing that education is associated with varying levels of trust in different information sources (Tsfati and Ariely, 2013) and institutions (Hakhverdian and Mayne, 2012), different media consumption habits (Shehata and Strömbäck, 2011), and different ways of adhering to health-preventive guidelines (Troiano and Nardi, 2021). We posit that these factors extend and integrate during crises, influencing how education shapes how individuals assimilate information and adhere to recommended guidelines.

Higher education potentially equips individuals with the capacity to assimilate and manage information from diverse channels, fostering trust not only in fellow individuals but public institutions (Charron and Rothstein, 2016). The significance of education is established in the prior studies concerning people's media consumption habits and access to information. Notably, this dynamic relationship has been further compounded by the role of internet

utilization as education emerged as an important determinant of internet use-with increased digital embeddedness, people's trust in traditional media declined (Tsfati and Ariely, 2013).

Access to information was essential during the COVID-19 crisis when receiving accurate information had significant implications for one's well-being. However, socioeconomic positions can determine how much people gain accurate information and evidence from the pandemic, showing that individuals in more privileged digital dispositions were more knowledgeable about COVID-19 (Hargittai, 2022).

Pre-pandemic research has identified a clear digital divide in health information-seeking habits, showing that younger and better-educated individuals use the Internet in a more sophisticated and comprehensive way (Neter and Brainin, 2012). People with lower health literacy are less likely to trust health information received from specialist doctors and more likely to trust such information from non-expert sources, such as television, social media, blogs, and celebrities (Chen et al., 2018). These differences in people's trusted information sources will likely lead to different outcomes: Those with better and more developed information-seeking skills better understand their healthcare needs and interact more effectively with healthcare professionals (Neter and Brainin, 2012). In health information-seeking, the source is particularly critical because the quality of information significantly affects health-related behaviour and decisions (Kitchens et al., 2014; Zhang, 2013). The perceived trustworthiness of the information source determines how the message recipient responds to communication and whether they will comply with recommendations (Meredith et al., 2007).

Our assumption about the importance of education is also based on prior research related to political trust, particularly on the prevailing evaluative approach. Within the realm of the trust-as-evaluation approach, scholars have meticulously explored how the performance and processes of institutions influence the trust levels of citizens (e.g., Kestilä-Kekkonen and Söderlund, 2014; van der Meer and Hakhverdian 2017). This theory underscores the continuous pressure public organisations face to align with societal norms and expectations to establish legitimacy and sustain trust. This alignment often manifests through formulating policies that not only address public concerns but exemplify ethical conduct, characterised by attributes like effectiveness, transparency, and responsiveness. Here, acknowledging education's pivotal role in enhancing individuals' ability to critically assess the performance of public actors is crucial. Education's role in the trust-as-evaluation approach becomes even more pronounced when considering cross-national comparisons. These comparisons reveal a discernible pattern: Education positively correlates with trust in societies characterised by lower corruption levels. Conversely, in countries where institutional functionality is compromised, the relationship between education and trust takes on a negative tone (Hakhverdian and Mayne, 2012).

Finally, education has also emerged as a consistent and influential factor in predicting vaccine acceptance—in studies conducted before and during the COVID-19 pandemic (Schmid et al., 2017; Wake, 2021). Numerous research endeavours have underscored that the level of formal education individuals attain contributes to their likelihood of accepting or, conversely, hesitating when embracing vaccination initiatives (Troiano and Nardi, 2021). Despite these insights, the specific role that trust in various information sources—such as health experts versus social media influencers—plays in mediating these educational differences in vaccine attitudes remains underexplored.

This study

Hypothesis

Trust in institutions is the key element determining how people behave during a crisis. As the extent of trust seems prone to changes in extraordinary and threatening situations, we investigate how people's trust in institutional and non-institutional information sources

varied. Drawing on the prior research showing consistently an increased institutional trust in the crisis, we assume that

(H1) *People exhibit higher levels of trust in institutional information sources than in social media influencers.*

Education is a critical determinant of trust in information sources, and individuals with higher educational levels have higher trust in public health institutions and mainstream media as information sources of COVID-19 (Latkin et al., 2020). Research also shows that satisfaction with the governmental response to COVID-19 varies by one's education level (Esaiasson et al., 2020). Given that media trust and political trust are connected on an individual level, and the trust in the news media depends on one's education, we expect the following:

(H2) *Individuals with master's level education exhibit greater trust in institutional information sources compared to those with lower educational attainments.*

(H3) *Individuals with master's level education exhibit lower trust in non-institutional information sources compared to those with lower educational attainments.*

Trust in traditional media and political institutions seems to strongly predict one's willingness to follow COVID-19 regulations (Adam et al., 2023; Devine et al., 2023). Following social media is associated with opposing views of the government and beliefs in COVID-19 myths; at a general level, only a minority of people preferred social media for COVID-19 information (Melki et al., 2021; Verbalyte and Eigmüller, 2020; Sabat et al., 2020). The social media environment is intensely polarised regarding views about the COVID-19 vaccine, and vaccine hesitancy is seemingly associated with engagement with low-quality online information (Rathje et al., 2022). Therefore, we assume that consuming traditional news media and leaning towards institutional information sources leads to support for governmental measures against the pandemic. We propose that

(H4) *Trust in institutional information sources is positively associated with individuals' attitudes on taking the COVID-19 vaccine.*

(H5) *Trust in social media influencers is negatively associated with individuals' attitudes on taking the COVID-19 vaccine.*

Research on factors explaining vaccine hesitancy and refusal shows that those with lower education are consistently less likely to take a COVID-19 vaccine (Robinson et al., 2021; Wake, 2021; Troiano and Nardi, 2021). Furthermore, among the most often reported reasons for vaccine hesitancy are general vaccine resistance and a lack of trust in information provided by healthcare professionals (Troiano and Nardi, 2021). Relying on the research evidence explaining differences in attitudes to COVID-19 vaccine uptake, we propose the following:

(H6) *Individuals with master's level education have more positive attitudes to taking the COVID-19 vaccine compared to those with lower educational levels.*

(H7) *The impact of educational level on COVID-19 vaccine attitudes operates indirectly through the mediation of trust in different information sources*

Data

We used Citizens' Pulse survey data from Statistics Finland and the Prime Minister's Office (Citizens' Pulse, 2021). This cross-sectional longitudinal survey is repeated multiple times per year, and each round consists of different groups of respondents. The persons included in the sample for Citizens' Pulse had expressed their willingness to respond to another survey when responding to three surveys (Statistics Finland's Labour Force Survey, Consumer Confidence Survey, or Finnish Travel Survey) in February 2021. The survey used a self-administered online questionnaire. In the various collection rounds, the sample sizes ranged between 2,428 and 2,850 individuals; the response rates ranged from 42.5% to 53.2%.

The survey rounds this study used examined Finnish people's attitudes and opinions during

the COVID-19 pandemic. The data used were collected in eight rounds in 2021, approximately every 45 days, from February to December. The final data set included all respondents who answered the key independent and dependent variables. The final dataset therefore included 8507 respondents, of whom 45.5% were male, 54.0% female and 0.4% identified as other. Of the respondents, 12.2% were under 30, 30–39 (15.0%), 40–49 (17.4%), 50–59 (21.5%), 60–69 (24.6%), and over 70 (9.3%), with 50.9% of respondents having a higher (bachelor's or master's-level) education. Therefore, the data concerning the Finnish population was slightly skewed, so weight variables were used in the analyses to weight the data to correspond to the target population (people aged 15–74 residing in mainland Finland).

The time period covered different phases of the COVID cycle, with the hardest lockdowns decreasing at the beginning of the year. However, the disease situation worsened towards the end of the year as the Omicron variant became more prevalent. The first COVID-19 vaccines arrived in Finland in December 2020; at the time of the surveys, the vaccine was available for everyone in Finland.

Measures

The main variable we used regarded respondents' trust in various sources of pandemic information. Respondents were specifically asked to evaluate the reliability of the information publicly provided by representatives of different groups concerning the COVID-19 crisis ('*How reliable do you consider the information publicly provided by representatives of the following groups about the COVID-19 crisis?*'). This study included five groups: political leaders, healthcare professionals, healthcare experts and researchers (grouped together), journalists, and social media influencers. Trust levels were assessed on a five-point scale where 1=untrustworthy, 2=somewhat untrustworthy, 3=neither trustworthy nor untrustworthy, 4=fairly trustworthy, 5=trustworthy. We combined categories 4 and 5 as well as 1–3 to create a dichotomous variable with a value of 1, indicating the "reliable" group to better understand the factors influencing the perception of information reliability and its impact on crisis behaviour.

The second important variable was the intention to get vaccinated. Respondents were asked, '*Do you agree or disagree: If a COVID-19 vaccine became available and was recommended to me, I would get it*?' The original response scale was a 5-point Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, and 5=Strongly agree. We took a similar starting point here as with the previous trust variables and measured the respondent's intention to get vaccinated, so we combined the response scales so that 1 to 3 were assigned a value of 0 and 4 and 5 a value of 1.

Our primary predictor was education level. This variable distinguishes respondents with basic education, those with upper secondary education, those with a bachelor's degree, and those with a master's.

Other background variables included the respondent's gender, age group, and perceived financial situation of the household. Gender was asked in three categories, separating men, women, and other genders. The age group includes five cohorts aged 20 to 69 (20–24, 25–29, 30–34, etc.). All those under 20 and those 70 or over are included in a separate category. When examining the impact of education, we focused only on respondents aged 30 or over, as we assumed that most respondents of this age would have completed their highest level of education. The household's financial situation was measured using the question, '*How do you feel about the financial situation of your household*?' The answers were given on a four-point scale with the following options: 1=Wealthy, 2=Well-off, 3=Middle-income, and 4=Low-income. Respondents could also say, "I don't know", if they could not ascertain their household's situation or declined to respond.

Finally, we controlled for COVID anxiety and satisfaction with the COVID-19 information. Regarding the COVID anxiety, respondents were asked how concerned they were about the COVID pandemic and its effects using a ten-point scale (1=Major concern – 10=No concerns). Concerning COVID-19 information

satisfaction, respondents were asked how well informed they were about the impact of the COVID crisis on their daily lives using a five-point scale (1=Very bad, 5=Very good).

Table 1 presents descriptive statistics for the variables.

Variables	Summary
Measurement point	
Round 1	1,093 (12.8%)
Round 2	1,198 (14.1%)
Round 3	1,037 (12.2%)
Round 4	1,086 (12.8%)
Round 5	1,060 (12.5%)
Round 6	1,024 (12.0%)
Round 7	984 (11.6%)
Round 8	1,025 (12.0%)
Trust in the different actors as COVID informants:	
Political leaders	5,540 (65.1%)
Healthcare workers	7,650 (89.9%)
Health experts and scientists	7,493 (88.1%)
Journalists	3,365 (39.6%)
Social media influencers	471 (5.5%)
*Intention to vaccine uptake**	
No	496 (9.2%)
Yes	4,899 (90.8%)
Education	
Basic	739 (8.8%)
Secondary	3,326 (39.7%)
Bachelor's	2,293 (27.3%)
Master's	2,029 (24.2%)
Gender	
Male	3,873 (45.5%)
Female	4,598 (54.0%)
Other	36 (0.4%)
*Age group***	
Under 30	1,037 (12.2%)
30–39	1,280 (15.0%)
40–49	1483 (17.4%)
50–59	1826 (21.5%)
60–69	2989 (24.6%)
70 or older	792 (9.3%)
Household's economic situation	
Cannot say	87 (1.0%)
Low-income	1,873 (22.0%)
Middle-income	4,054 (47.7%)

Well-off	2,211 (26.0%)
Wealthy	276 (3.2%)
COVID anxiety (0–10)	6.160 (2.223)
Satisfaction with Covid information (1–5)	4.085 (0.868)
N	8,507

* measured only during the first five rounds

** used as continuous

Table 1. Descriptive statistics of the study variables (unweighted distributions)

Analysis procedure

Our study employed a comprehensive analysis to investigate the dynamics of trust in information sources and its influence on the Finnish population's intention to take the COVID-19 vaccine during the pandemic's second year. Our analytical process unfolded in the following steps:

We began with a descriptive analysis to find the development of trust in different information sources during the pandemic. This was followed by two-sample proportion tests to examine overall trust disparities between social media influencers and institutional information sources, addressing our first hypothesis.

The analysis then shifted focus towards the impact of education to test the second and third hypotheses, employing both descriptive analysis and linear probability models to assess how education and other background variables were associated with trust in different information sources. Then, we analysed the relationship between trust levels and vaccination intentions, addressing the fourth and fifth hypothesis, by using again a descriptive overview and linear probability models.

The final phase involved using the Karlson-Holm-Breen (KHB) method for a detailed decomposition of the relationship between education and vaccine intention according to trust in different information sources. By using this method, we tested the sixth and seventh hypothesis by estimating the total and direct effects of education on vaccine intention as well as indirect effect of education through trust in different information sources.

The entire analysis was conducted using STATA 18 software. The decomposition was performed using the specialised KHB command, specifically designed to handle nonlinear relationships (Kohler et al., 2011). The coefplot command was used in illustrating the main effects.

Results

First, we measured people's most trusted information sources about COVID-19 during eight phases of the pandemic in 2021. Table 1 shows that people's most trusted information sources were healthcare workers: doctors and nurses, official healthcare experts, and scientists. Evidently, the least trusted information sources were social media influencers. The separate tests confirmed our first hypothesis as SMIs were less likely trusted when compared to healthcare workers (pr. diff.=-0.847, $p<0.001$), health experts and scientists (pr. diff. =-0.825, $p<0.001$), political leaders (pr.diff=-0.599, $p<0.001$), and journalists (pr.diff = -.355, $p<0.001$).

Figure 1 illustrates the development of trust throughout 2021. As the pandemic persisted, there was a notable increase in trust towards healthcare professionals, along with health experts and scientists, as reliable sources of information. Conversely, the level of trust in politicians declined. Meanwhile, the trust in SMIs and journalists remained consistent.

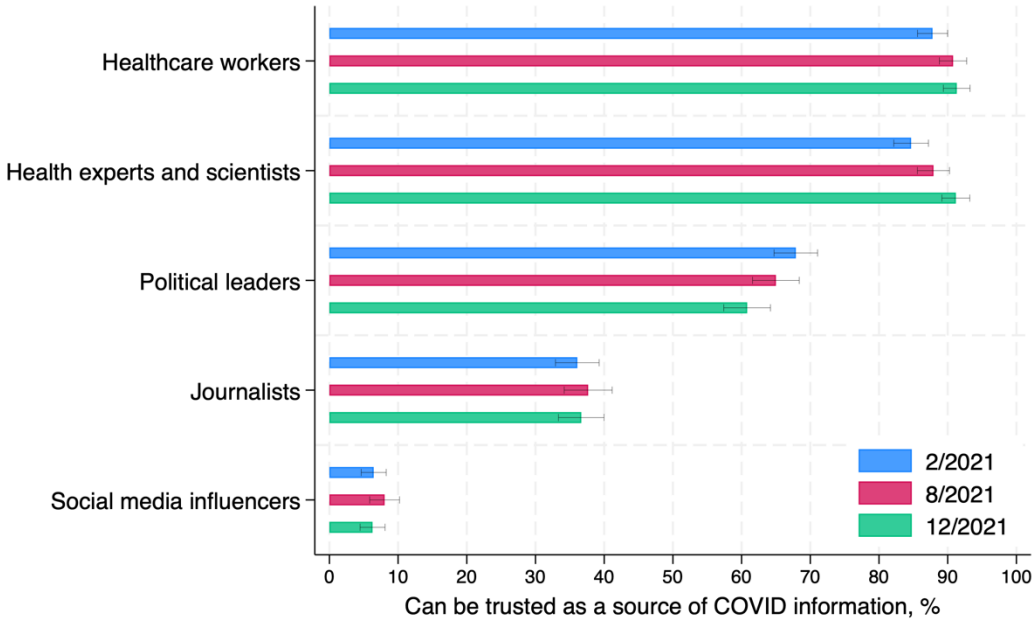

Figure 1. Trust in information sources as mediators of COVID-19 information in 2021

Next, we focused on the impact of education. Figure 2 highlights that higher education correlates with increased trust in health experts and scientists. Notably, those with a master's degree show clearly more trust in journalists and political leaders than other educational groups. Finally, there is a significant difference between the most and least educated groups in terms of trust in SMIs: about 15% of those with only basic level education trusted SMIs, compared to 2,5% among those holding a master's degree.

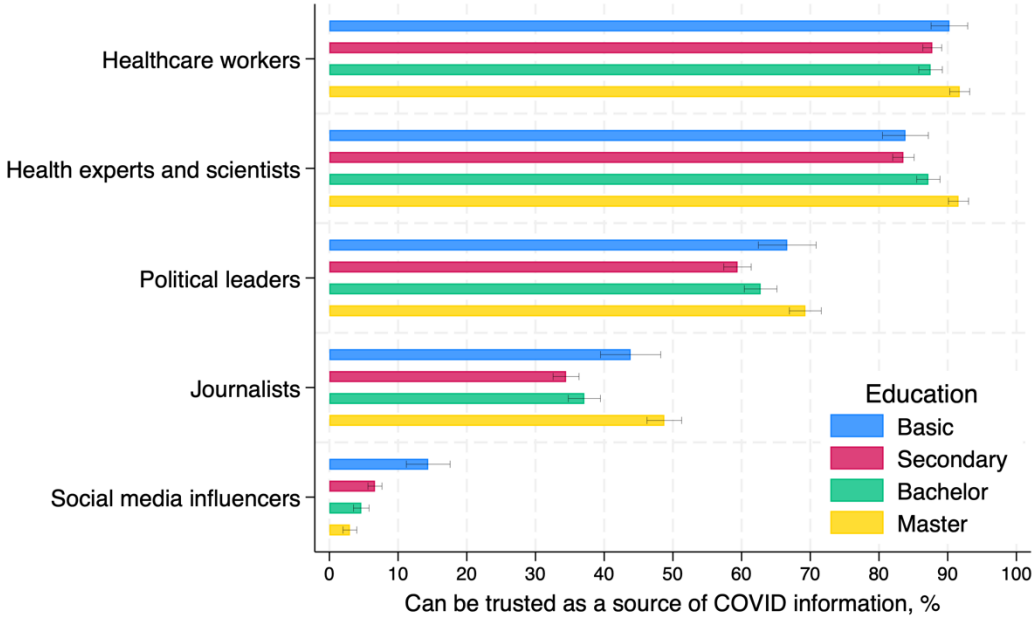

Figure 2. Trust in different actors as a source of COVID-19 information according to educational level in 2021 (respondents over 30),

We tested our second and third hypotheses using linear probability models. The results presented in Table 2 largely confirm our second hypothesis, indicating that education at the master's level is associated with higher trust in institutional sources, including healthcare workers, health experts, scientists, journalists, and political leaders, compared to those with lower levels of education. We did not find a statistically significant difference (at the 95% confidence level) when comparing individuals with master's-level education to those with basic-level education in terms of trust in political leaders and healthcare workers as information sources, but the trend was similar.

The results unequivocally supported our third hypothesis, demonstrating that those with less than a master's degree are more likely to trust social media influencers. The most pronounced difference was observed between individuals with a master's degree and those with an undergraduate degree.

VARIABLES	The probability of trusting: Political leaders	Health workers	Health experts and scientists	Journalists	Social media influencers
Education					
Basic	-0.030	-0.031	-0.080***	-0.076**	0.130***
	(0.024)	(0.017)	(0.019)	(0.027)	(0.019)
Secondary	-0.075***	-0.034**	-0.064***	-0.136***	0.047***
	(0.016)	(0.011)	(0.011)	(0.017)	(0.009)
Bachelor's	-0.049**	-0.034**	-0.031**	-0.105***	0.024**
	(0.016)	(0.011)	(0.011)	(0.017)	(0.008)
Master (Ref)					
Women	0.096***	-0.009	0.029**	0.022	0.015*
	(0.012)	(0.008)	(0.009)	(0.012)	(0.007)
Age	0.000	0.005**	0.004*	0.009***	-0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Income:					
Low (ref)					
Middle-income	0.027	0.020	0.029*	-0.008	0.000
	(0.016)	(0.012)	(0.012)	(0.017)	(0.010)
Well-off	0.012	0.017	0.033*	-0.007	0.010
	(0.018)	(0.013)	(0.014)	(0.019)	(0.012)
Wealthy	-0.089**	0.008	-0.003	0.054	0.013
	(0.034)	(0.027)	(0.030)	(0.039)	(0.024)
	0.001	-0.001	0.000	0.003	0.004
COVID anxiety	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Satisfaction with Pandemic information	0.210***	0.087***	0.130***	0.129***	0.018***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.004)
Constant	-0.303***	0.505***	0.251***	-0.165***	-0.088***
	(0.042)	(0.037)	(0.039)	(0.044)	(0.025)
Observations	8,595	8,476	8,661	8,357	7,543
R-squared	0.175	0.066	0.129	0.075	0.029

Time-fixed effects; Respondents over 30
Robust standard errors in parentheses;
*** p<0.001, ** p<0.01, * p<0.05

Table 2. The likelihood of trusting different actors as a source of COVID-19 information by education and other background variables. Linear probability models

The models also reveal insights into variation across background variables. Women generally exhibiting show more trust than men in most sources, except for healthcare workers. Younger people displayed more trust in SMIs, while older people placed greater trust in traditional institutions and journalists. The wealthiest respondents exhibited less trust in political leaders, but economic status did not significantly predict trust in other sources. COVID-19 concerns had no direct link to trust levels, whereas overall satisfaction with the availability of COVID-19 information correlated with increased trust across various sources.

Next, the fourth, fifth and sixth hypotheses were tested by analysing how trust in different information sources and education are related to attitudes towards vaccination. The first model in Table 3 supported the fourth hypothesis, showing that trust in institutional sources is positively associated with favorable attitudes towards vaccination. Similarly, the fifth hypothesis was confirmed, with a negative association between trust in SMIs and vaccination intentions. The second model examined the impact of education, confirming our sixth hypothesis that individuals with a master's level education exhibit more favorable attitudes towards vaccination compared to other educational groups. Figure 3 illustrates the results of M1 and M2 showing the marginal effects of trust in different information sources and education on vaccine intention.

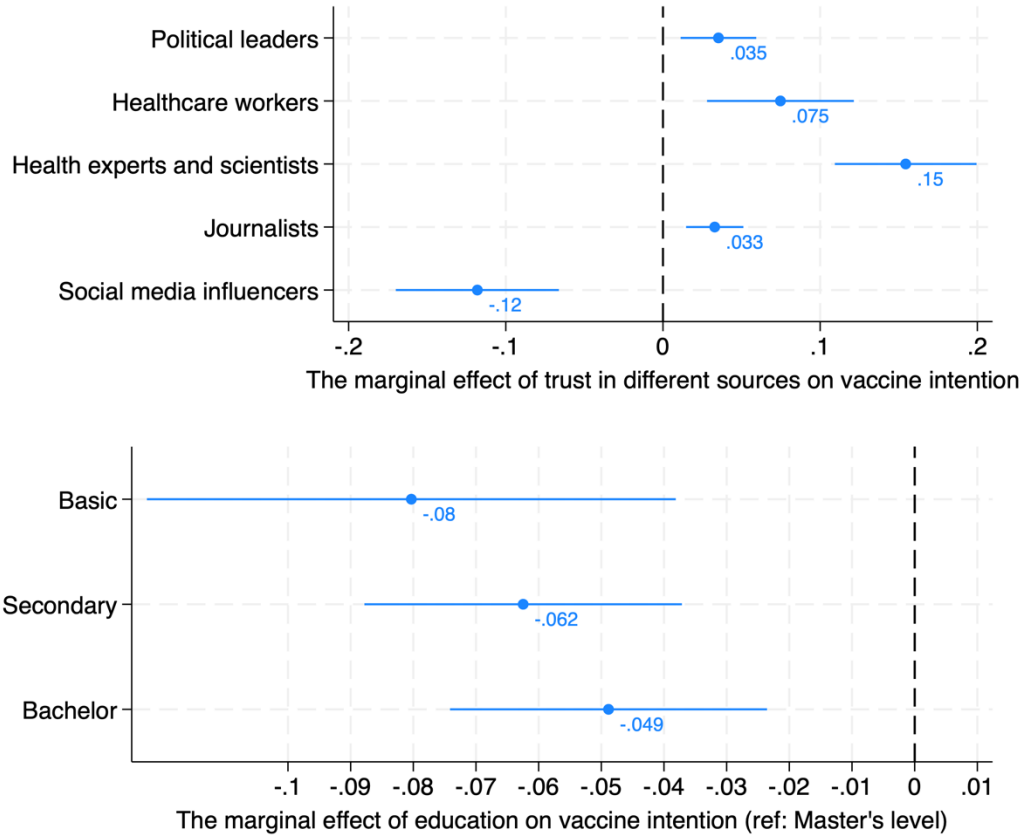

Figure 3. Marginal effects of education and trust in different information sources on the likelihood of getting vaccinated, adjusted estimations from

Finally, we focused on interdependence between trust in different information sources and education. The third model in table 3 incorporates trust variables alongside education and background variables. The influence of trust variables remains consistent with the first model. However, when trust variables are added to the model, the relationship between education and vaccination attitudes appears to change, which we will explore separately with the KHB analysis.

VARIABLES	M1		M2		M3	
Trust in different information sources:	*B*	*SE*	B	SE	B	SE
Political leaders	0.035**	(0.012)			0.036**	(0.012)
Healthcare workers	0.075**	(0.024)			0.076**	(0.024)
Health experts and scientists	0.154***	(0.023)			0.149***	(0.023)
Journalists	0.033***	(0.009)			0.027**	(0.009)
Social media influencers	-0.118***	(0.026)			-0.113***	(0.027)
Education						
Basic			-0.080***	(0.022)	-0.048*	(0.021)
Secondary			-0.062***	(0.013)	-0.041**	(0.012)
Bachelor's			-0.049***	(0.013)	-0.036**	(0.012)
Master's (Ref)						
Women	0.016***	(0.002)	-0.011	(0.010)	-0.017	(0.009)
Age	-0.015	(0.009)	0.019***	(0.002)	0.018***	(0.002)
Middle-income	0.008	(0.013)	0.013	(0.014)	0.004	(0.014)
Well-off	0.045**	(0.014)	0.040*	(0.016)	0.031*	(0.015)
Wealthy	0.016	(0.031)	0.009	(0.031)	-0.000	(0.032)
COVID anxiety	-0.011***	(0.002)	-0.011***	(0.003)	-0.011***	(0.002)
Satisfaction with pandemic information	0.002	(0.007)	0.040***	(0.007)	0.002	(0.008)
Constant	0.577***	(0.041)	0.581***	(0.046)	0.559***	(0.047)
Observations	4,678		4,603		4,603	
R-squared	0.133		0.067		0.134	

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 3. The likelihood of getting vaccinated by education and trust in different actors as a source of COVID-19 information. Linear probability models

Table 4 displays the outcomes of the KHB analysis, illustrating that the disparity in vaccine intention between master's degree and less educated groups is partly mediated by trust variables. The model indicates that considering trust in various sources reduces the difference between the most educated and less educated individuals by about 31%. A closer examination of the mediation effect of trust reveals that it's particularly the trust in healthcare experts and SMIs that elucidates the significance of educational differences in vaccine uptake. Specifically, the elevated trust that the most educated individuals have in healthcare experts and scientists correlates with their greater likelihood of getting vaccinated compared to those with only primary education. Concurrently, the diminished trust in SMIs among the highly educated also plays a role in their increased vaccine uptake.

VARIABLES	Basic		Secondary		Bachelor	
Total effect of Master's degree	-1.124***	(0.326)	-0.920***	(0.198)	-0.790***	(0.199)
Direct effect of Master's degree	-0.766*	(0.330)	-0.665***	(0.200)	-0.636**	(0.201)
Indirect effect of Master's degree via trust in different information sources:	-0.358***	(0.084)	-0.255**	(0.080)	-0.153*	(0.077)
Political leaders	-0.026	(0.017)	-0.041	(0.018)	-0.019	(0.011)
Health workers	-0.015	(0.013)	-0.013	(0.008)	-0.013	(0.009)
Health experts and scientists	-0.104	(0.033)	-0.074	(0.021)	-0.030	(0.018)
Journalists	-0.031	(0.021)	-0.073	(0.029)	-0.053	(0.022)
Social media influencers	-0.182	(0.047)	-0.054	(0.017)	-0.039	(0.016)
Mediation percentage	31.8%		27.7%		19.4%	
Observations	4,603					

Non-standardised coefficients when compared to "Master's degree"; Robust standard errors in parentheses; Model controls for age, gender, economic situation, COVID fear, and satisfaction with COVID information

*** p<0.001, ** p<0.01, * p<0.05

Table 4. The decomposition of educational differences in vaccine uptake according to trust in different actors as a source of COVID-19 information

Discussion

The first hypothesis, which states that people rely more on institutional experts and healthcare professionals than SMIs when the health risks are the highest, was confirmed. SMIs were the least trusted information source for most people, and only a tiny minority considered them a trustworthy source of COVID-19 information. So far, the actual influence of SMIs has remained unclear, but according to this study, despite their growing popularity, they have not generally gained a position as a trusted source of COVID-19 information. Prior work suggests SMIs might be opinion leaders, especially for younger audiences (Abidin et al., 2021; Andrews et al., 2020). Our results showed that younger people trusted SMIs more than older people. However, we focused on the importance of education and limited the data to those 30 or older. Thus, future research could explore what factors specifically predict young people's trust in

influencers and the wider consequences of doing so.

Confirming the second and third hypotheses, we found a significant effect of education in trusting institutional information sources and SMIs: Higher education predicts higher trust in institutional information sources (H2), whereas lower education predicts higher trust in SMIs (H3). These results underline previous research on the role of education in information search and acquisition (Neter and Brainin, 2012; Hargittai, 2022), further establishing that in contexts like Finland, where corruption is low and institutions function effectively, higher education levels are associated with increased trust in a range of institutional information intermediaries (Hakhverdian and Mayne, 2012).

Analysis of vaccine intentions supports the fourth and fifth hypotheses, revealing that trust in institutional sources correlates with positive COVID-19 vaccine attitudes (H4), while trust in SMIs is linked to vaccine hesitancy (H5). These results align with recent studies showing that social media trust predicts lower vaccine uptake and thus higher mortality from COVID-19 (Chen et al., 2023), and social media (as well as avoiding official information sources) strengthen anti-vaccine attitudes among heavy social media users (Chadwick et al., 2021). Although the number of those who trusted SMIs was small on the population level, this group was significantly more sceptical towards vaccination than others. Despite some having recommended using SMIs in public communication about COVID-19, they were not a trusted source of COVID information. In fact, social media tends to attract individuals whose trust in traditional information sources is weaker and who are more sceptical about institutional authorities and public health policies.

Furthermore, confirming the sixth hypothesis, we found that higher education predicts a higher likelihood of vaccine uptake while lower education predicts a lower likelihood of vaccine uptake. Finally, analysing the indirect effects showed that trust in healthcare experts and SMIs explains the significance of education. Confirming the seventh hypothesis, high trust in healthcare experts—typical of highly educated individuals—is associated with their higher likelihood of getting vaccinated.

This study confirms that social media gives visibility to opposing and protesting views, which may harm health behaviour. SMIs were deemed a major source of disinformation, but our findings can greatly reduce the concerns about their danger to people's awareness of COVID-19 recommendations. However, because trust in SMIs is associated with distrust in institutional experts, more attention should be paid to this small but distinct group, for whom social media is the primary source of health information and who may ignore institutional health information sources. As one's education level explains the differences in trusted sources, these differences and their outcomes for health behaviour create a new digital divide between people.

Conclusion

Despite the recent concerns about the 'Infodemic', the findings show that in the context of the pandemic, cognitive authority is strongly linked to formal expertise. Interestingly, new information intermediaries, social media influencers, were the least trusted source of COVID-19 information. Overall, the pandemic has shown how important good quality information is for managing the crisis, as people's trusted information sources have an impact on their crisis behaviour and vaccine uptake. Denoting to the cognitive authority theory, we suggest that credibility of an information source is relational and actors who are perceived as experts in one topic are not experts in all other topics. As for SMIs, their expertise appears to be more confined, particularly to less-educated groups.

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