Uncertainty Communication in a High-Trust Society:
Source Type, Political Preference, and Trust

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Studies of uncertainty communication have produced mixed results concerning the consequences for trust. In this article, we focus on uncertainty communication as it concerns trust in a message about vaccine effectiveness and safety, seeing source type and political preference as mediators. These factors have become increasingly important as public health issues are becoming politicized in several countries. To test these relationships, we conducted a survey experiment in Norway—a high-trust society. Our results show a consistent tendency that statements expressing certainty were trusted more, especially when the source of the statement was the government or public health authorities. Importantly, however, the differences between statements expressing certainty and uncertainty were small. Also, when asked about their trust in messages from the public health authorities, respondents' political beliefs played a minor role. The relatively high acceptance of uncertainty communication may be interpreted in the light of generally high levels of trust in authorities, as well as low levels of polarization in the Norwegian context, in general, and in the context of the pandemic.

Keywords: uncertainty, trust, COVID-19, public health institutions, politicization

A recurring issue for communicators is how to communicate uncertainty in risk and crisis situations without producing anxiety and harming trust. For instance, when launching a vaccine during a public health crisis like the COVID-19 pandemic, should the public health authorities attempt to reassure the public with confident messages about vaccine effectiveness and safety? Or should they add qualifiers to such messages? What are the consequences for trust? In general, research has produced mixed results concerning transparency about uncertainty (Paek & Hove, 2020). Some studies point to positive effects, urging

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transparency about what is known and not known (e.g., Covello, 2003; Liu, Bartz, & Duke, 2016). Others, however, have pointed to negative consequences, such as confusion and mistrust in the competence of public health authorities (Guttman & Lev, 2021; Johnson & Slovic, 1995, 1998). A third strand of studies has shown that the effects of uncertainty communication can differ among different nations, issues, and phases (Kelp, Witt, & Sivakumar, 2022; Zehr, 2017). And, finally, a fourth group has concluded that few clear effect patterns can be found (Chen, Dai, Xia, & Zhou, 2022; Jensen et al., 2017). Taken together, these mixed results demonstrate the need for further research on the conditions for uncertainty communication and trust (Balog-Way & McComas, 2020; Driedger, Maier, & Jardine, 2021; Janssen, Hendriks, & Jucks, 2021; Paek & Hove, 2020).

In this article, we explore this topic by asking three research questions: How is citizens' trust in a message about the effectiveness and safety of COVID-19 vaccines influenced by the degree of certainty/uncertainty in its statements? How are trust levels affected by the source of the message? And how are trust levels mediated by political preferences? These questions are addressed by means of a survey experiment where we randomly varied the content (certainty/uncertainty) and source (government, public health authority, left-wing and right-wing politicians) of the messages about the effectiveness of vaccination against COVID-19. Respondents were asked about their trust in the messages and their confidence in the safety of the vaccines. Testing causal effects through experiments has been identified as a crucial research gap that warrants attention to address health communication problems (Lin & Nan, 2022).

The experiment was carried out in Norway in May 2021. At this point during the pandemic, the Pfizer/BioNTec and Moderna vaccines were being rolled out in Norway, and scientific advice was unequivocal that these two vaccines were effective and harmless. However, the survey was conducted right after the Norwegian Institute of Public Health (NIPH) had decided to abandon a third type—Astra Zeneca—due to serious side effects (NIPH, 2022) acknowledging that caution was warranted in the face of uncertainty. Although various surveys suggested very high vaccine uptake in the Norwegian population, one could argue that such a situation of *uncertainty* regarding vaccines was advantageous to our experiment since public attitudes toward vaccines were probably not fully crystallized.

Norway lends itself well as a case as the nation has low levels of political polarization (Knudsen, 2020; Torcal, 2017), high prior support for vaccination programs (Steens, Stefanoff, Daae, Vestrheim, & Riise Bergsaker, 2020), and high levels of initial trust, all of which contributed to the relatively successful handling of the COVID-19 pandemic (Christensen & Laegreid, 2020; Norges Offentlige Utredninger, 2021, 2022). A four-wave survey commissioned by us also showed high and stable levels of trust in the authorities' handling throughout the pandemic (Wollebæk, Fladmoe, & Steen-Johnsen, 2022). Given this context, citizens might be more accepting toward communication of uncertainty.

Next, we define what we mean by trust and discuss the relationship between trust, the communication of uncertainty, source type, and citizens' political preferences. This is followed by a section presenting the survey experiment methodology before we turn to the results of the experiment. In the concluding section, we discuss the research questions and the implications of the findings in more detail.

Theory and Hypotheses

Foundations for Trust

In organizational research, one of the most cited definitions of trust belongs to Mayer, Davis, and Schoorman (1995), who see trust as

> *the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party.* (p. 712; emphasis in original)

Based on this, we operationalize trust as whether the citizens (qua trustors) are willing to take at face value a message from a particular source (a trustee), such as politicians or the health authorities. Trust manifests itself in the willingness to trust a particular message from the trustee.

Trust in this sense is an essential coping mechanism people use when they lack sufficient information or expertise to make an objective decision (Siegrist & Cvetkovich, 2000). In the context of this paper, a pertinent question is whether a particular message about vaccine effectiveness can be trusted. The message might have consequences for the respondents' confidence in the safety of the same vaccines. Ultimately, this form of trust will be predicated on the characteristics of the message, the sources, as well as the receivers (Baer & Colquitt, 2018).

Message: Communication of Uncertainty

Uncertainty can be defined as "any departure from the unachievable ideal of complete determinism" (Walker et al., 2003, p. 8). It is an aspect that has been discussed in relation to many issues, including media (Ribeiro & Zelizer, 2022), climate change (Lambert & Eise, 2020), crises (Liu et al., 2016), as well as vaccination (Pertwee, Simas, & Larson, 2022). In the context of a pandemic like COVID-19, changes in the strategy to handle the pandemic could lead to uncertainty rooted in *contradictions* creating an appearance of inconsistency. Frequently, uncertainty is also produced by the very *ambiguity* of the situation—the many contextual factors that allow for several different interpretations (Markon & Lemyre, 2012; Markon, Crowe, & Lemyre, 2013).

The rollout of COVID-19 vaccines in Norway, however, primarily involved *ontological* and *epistemological* uncertainty. As for the former type, it is defined as uncertainty concerning the very system and the parts that make it up, whereas the latter points to the absence of firm knowledge about the problems and solutions at hand (Markon & Lemyre, 2012; Markon et al., 2013). Ontological and epistemological uncertainty are, in general, also issues that are seen as crucial for vaccine hesitancy (MacDonald, 2015; Rozek et al., 2021). As mentioned, the context of the present study was the spring of 2021, when vaccination efforts were well underway in Norway, but effectiveness and safety were still debated. In March 2021, the Astra Zeneca vaccine was suspended due to its side effects, and three deaths were related to the use of this vaccine type (NIPH, 2022). Thus, the period may have been

characterized by some level of ontological and epistemological uncertainty about the serious side effects of vaccines in general.

Studies of science communication have shown that message adherence and trust are weakened when experts disagree (Gustafson & Rice, 2020; Markon & Lemyre, 2012; Markon et al., 2013). Similarly, previous studies of vaccine communication have concluded that scientific uncertainty leads to declining vaccination intent (Han et al., 2018). In a Canadian study of uncertainty communication during the H1N1 pandemic, a health professional was quoted as saying, "Instead of gaining credibility by saying, 'Hey, we're adapting to what we know and what we don't know,' that worked against us" (Driedger et al., 2021, p. 584). The latter study also included citizen focus group research where some participants called for clear, uniform messages from the health system rather than conflicting messages from different expert groups or different levels of the government.

Expressing uncertainty can be construed as lacking competence, and therefore something to be avoided (Guttman & Lev, 2021; Johnson & Slovic, 1995, 1998). Furthermore, it has been pointed out that it is difficult for laypeople to process information about uncertainty and that such information might create disturbance and frustration and cause people to overestimate risk (Capurro, Jardine, Tustin, & Driedger, 2021; Lofstedt & Bouder, 2017; Maier et al., 2016; Slovic, 1987). Ultimately, some scholars have concluded that trust is negatively influenced when the authorities communicate about uncertainty (Bakker, van Bommel, Kerstholt, & Giebels, 2019; Driedger et al., 2021).

On the other hand, several studies reached the opposite conclusion: Being transparent about uncertainty and giving information about possible outcomes are thought to establish and strengthen trust (Covello, 2003; Hendriks, Janssen, & Jucks, 2022; Liu et al., 2016), or at least such communication does not appear to have negative effects on trust (Brashers, 2001; Gustafson & Rice, 2020; van der Bles, van der Linden, Freeman, & Spiegelhalter, 2020). Indeed, a set of studies indicated that the public is quite apt at coping with uncertainty (Brashers, 2001; Crowley, Bleakley, Silk, Young, & Lambe, 2021). Importantly, acceptance of uncertainty is higher when it is tied to the scientific process rather than when the uncertainty stems from lack of action (Frewer et al., 2002). Some research has also argued that uncertainty communication is particularly helpful for the authorities if new knowledge means that previous projections do not hold and advice must be changed (Batteux, Bilovich, Johnson, & Tuckett, 2022; Kelp et al., 2022; Kreps & Kriner, 2020).

A German survey showed that most citizens expressed a *preference* for uncertainty communication during the COVID-19 pandemic (Wegwarth, Wagner, Spies, & Hertwig, 2020). Focus group research in three high-trust countries, Denmark, Norway, and Sweden, echoed these findings. The COVID-19 pandemic was characterized as a particular case by one participant: "There is every reason to be uncertain when something occurs where we do not have any empirical basis that can inform knowledge-based decisions. It is necessary that we feel our way" (Skogerbø, Ihlen, Kjeldsen, & Vranic, submitted). The impression is that several people felt that communication of uncertainty strengthened their trust in the public health authorities, given the situation. Indeed, in the public evaluation reports in Norway (Norges Offentlige Utredninger, 2021, 2022), the authorities were commended for the

communication of uncertainty, and surveys showed that trust in public authorities was high throughout 2020 and 2021 (Norges Offentlige Utredninger, 2021, 2022).

In sum, past research provides evidence supporting both communication strategies emphasizing certainty, and communication strategies emphasizing uncertainty. Thus, we propose two competing hypotheses with regard to the pandemic situation in Norway:

H1a: *Statements of certainty will produce higher levels of trust in the message and confidence in vaccine safety.*

H1b: *Statements of uncertainty will produce higher levels of trust in the message and confidence in vaccine safety.*

Trustee: Importance of Source

As indicated above, we see trust as a relationship between a trustor and a trustee that extends to trust in the messages from the trustee. In addition to discussing the characteristics of the message (here uncertainty/certainty), it is necessary to assess the effect of source type. The effect of source type is often researched by looking at the *trustworthiness* of the trustee—the perceptions a trustor has of the ability, integrity, and benevolence of a trustee (Mayer et al., 1995). In studies of vaccine communication, lack of trust in science and experts has been mentioned as key (Baumgaertner, Carlisle, & Justwan, 2018; Kennedy, 2019). Still, in general, scientists are typically more trusted as sources than politicians (e.g., Hendriks et al., 2022). Scientists are rated more favorably for ability and integrity than the latter, who are seen as having more of a persuasive intent based on their own interests rather than truthful sharing of knowledge. Janssen and colleagues (2021), for instance, had participants read a text that suggested either strong or conditional support for mask wearing during COVID-19. The source was either a politician or a scientist. The scientists were considered more trustworthy than the politicians, and hedging statements did not affect trustworthiness. Thus, we formulate the following hypothesis:

H2:   *Messages about vaccines will be more trusted and lead to more confidence in vaccine safety when the source is nonpolitical.*

Trustor: The Mediating Role of Political Preferences

There are obviously many different variables that come into play when looking at the antecedents for trust as they are tied to the trustor; these include, for instance, age, gender, education, science literacy, as well as trusting dispositions—a tendency to rely on what is said and done by others (Baer & Colquitt, 2018). In this article, however, we focus on political preference, which is a factor that has become increasingly important for trust in health communication messages (Baumgaertner et al., 2018; Cairns, de Andrade, & MacDonald, 2013; Liu & Mehta, 2020). With regard to COVID-19 related matters, for instance, such preferences have led some voter segments within the Republican Party in the United States to trust former president Donald Trump more than scientists (see e.g., Jones-Jang & Noland, 2022; Nan, Iles, Yang, & Ma, 2022). However, it is an open question whether such findings hold

outside the polarized U.S. context, and, as previously argued, Norway is a good test case due to high levels of trust in both bureaucratic and political institutions (Torcal, 2017) and low levels of political polarization (Knudsen, 2020). Although specific containment policies were debated during the pandemic, none of the established political parties questioned the need for basic measures, including mass vaccination (Steens et al., 2020). Nevertheless, previous studies indicate a political-ideological effect on vaccine attitudes at the individual level, that is, in the sense that those who are broadly affiliated with a right-wing ideology tend to be more reluctant about vaccination (Wollebæk, Fladmoe, Steen-Johnsen, & Ihlen, 2022). Considering these factors, we propose the following hypotheses:

H3:   *Messages about vaccines will be more trusted and lead to more confidence in vaccine safety if delivered by a politician with similar views rather than a politician with opposing views.*

H4:   *Respondents supporting right-wing parties will express lower levels of trust in messages about vaccines when the source is the public health authorities compared with respondents supporting left-wing parties.*

Data and Methods

To assess the importance of statements expressing certainty/uncertainty, source type, and political preference, we conducted a vignette experiment. The experiment was included in a Web-based survey on citizens' trust in, and reactions to, public policies during the COVID-19 pandemic in Norway, carried out in May 2021. The survey was administered by Kantar Norway, and the sample was drawn from Kantar's access panel, stratified by gender, age, and education. The panel consists of approximately 50,000 Internet users and is probability based; respondents are not self-recruited but invited to join by means of random samples of the Norwegian adult population. Due to varying response rates in the stratified groups, respondents aged under 30, respondents without higher education, and respondents of immigrant descent were somewhat underrepresented in the final sample.

The experiment was a 2 × 4 vignette design, varying the content of the statement (certainty, uncertainty) and the source (Far-Left politician, Far-Right politician, the government, and the NIPH). Respondents were randomly assigned to one of eight possible groups, and given the following text to read (the texts in brackets varied across the eight groups):

Consider [a politician from the Socialist Left party/a politician from the Progress Party/the government/the National Institute for Public Health] expressing: "We are [absolutely certain/believe] that the vaccines protect against corona disease. Vaccination [will also/will probably also] reduce the spread of the infection, [scientists are in no doubt/but scientists are in doubt as to how much]."

After reading a version of this vignette, respondents were asked two questions: "To what extent would you trust this statement?" and "Would this statement make you more or less confident that vaccines are safe?" Both questions were answered using 7-point Likert scales (1 = to a very small extent/less confident, 7 = to a very large extent/more confident). While the first question is a measure

of trust in the message more generally, the second question is more detailed, asking for an evaluation of the content.

The two variables were strongly correlated ($r = 0.69$) and were collapsed into a single index measuring "trust in vaccine communication and confidence in vaccine safety," thus becoming the main dependent variable. Results for each item are reported in Appendix A.

Table 1 sums up the sample; how respondents were distributed across groups, the numbers of missing responses, sociodemographic characteristics, and political preference (operationalized as party preference). The table shows that there were more missing values (either skipping the question or responding "don't know") among respondents in vignettes where the source was a politician, especially a Far-Right politician. The gender distribution (share of male respondents) varied between 47% and 53% across the groups, the average age varied between 53 and 57 years, the share of respondents with higher education (university or college) varied between 58% and 66%, the share of respondents supporting left-wing parties (Red, Socialist Left, Labor) varied between 28% and 37%, and the share of respondents preferring right-wing parties (Conservative, Progress) varied between 22% and 29%. Due to these variations, we estimated regression models both with and without control variables (see Appendix B). Theoretically, in a randomized experiment, the treatment effects should not be affected by including such controls, and despite the variations across treatment groups, such was also the case here.

Table 1. Descriptive Statistics.

Content of Statement	Source	n	% Missing Values	% Male	Mean age	% Higher Education	% Vote Left-Wing Parties	% Vote Right-Wing Parties
Certainty	Far-Left politician (SV)	240	93.8	52.5	53.0	58.8	27.9	26.7
Certainty	Far-Right politician (FrP)	235	89.7	51.1	54.1	60.0	35.3	28.5
Certainty	The government	252	96.9	46.8	56.6	59.5	29.0	29.4
Certainty	The NIPH	256	95.9	51.2	54.7	65.6	33.6	22.3
Uncertainty	Far-Left politician (SV)	246	92.5	53.3	54.9	58.1	31.3	26.4
Uncertainty	Far-Right politician (FrP)	238	87.2	47.1	53.5	59.7	36.6	25.2
Uncertainty	The government	231	96.3	50.2	55.1	62.8	30.7	24.7
Uncertainty	The NIPH	253	96.9	48.2	54.5	58.9	28.5	26.1
Total		**1951**	**93.6**	**50.0**	**54.6**	**60.4**	**31.6**	**26.1**

Note. Statement of certainty: "We are absolutely certain that the vaccines protect against corona disease. Vaccination will also reduce the spread of the infection; scientists are in no doubt." Statement of uncertainty: "We believe that the vaccines protect against corona-related diseases. Vaccination will probably also reduce the spread of infection, but scientists are in doubt as to how much."
SV: Socialist Left Party; FrP: Progress Party.
Parties that vote Left: Red, Socialist Left Party, Labor Party. Parties that vote Right: Conservative Party, Progress Party.

Results

The Effect of (Un)Certainty Communication on Trust and Confidence in Vaccine Safety

As illustrated in Figure 1, the results show that messages that express certainty are more trusted and lead to more confidence in the safety of the vaccines than statements expressing uncertainty. The difference is most pronounced for vaccine safety. Thus, H1a—that statements of certainty will produce higher levels of trust and more confidence in vaccine safety—is supported, while H1b (uncertainty produces more trust) is rejected.
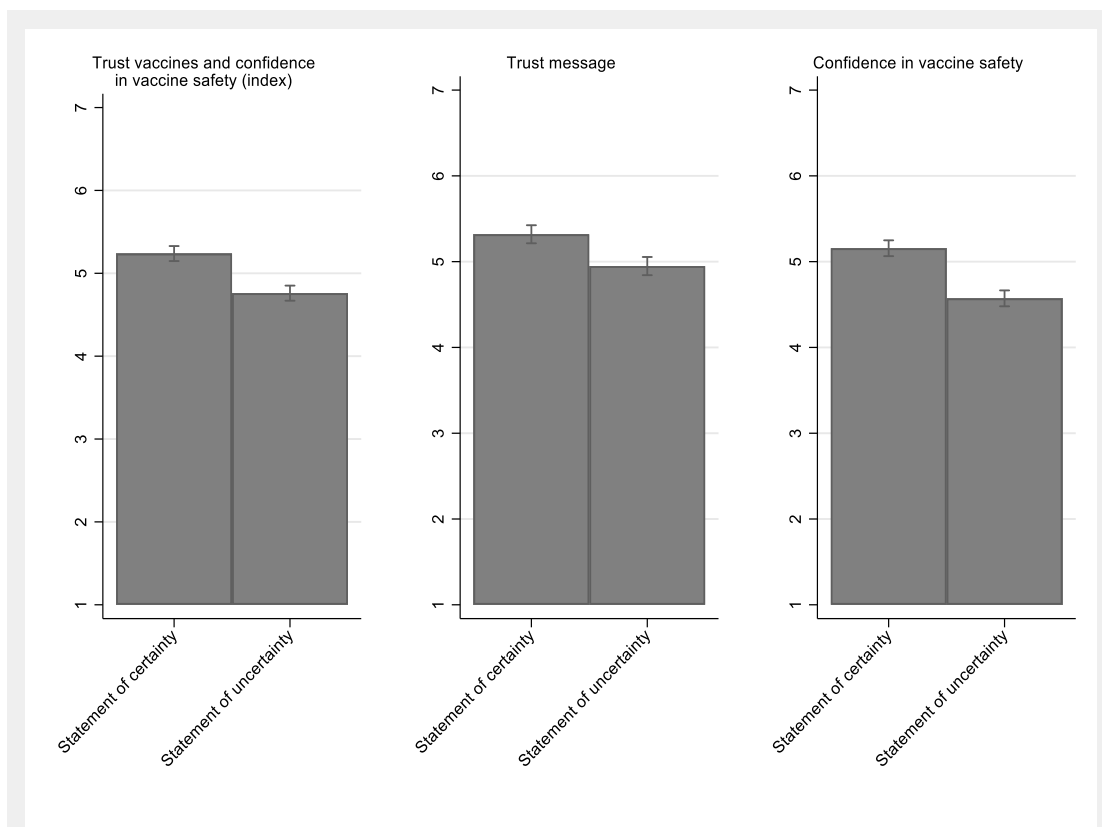

Figure 1. The effect of (un)certainty communication on trust and confidence in vaccine safety.

The Source Effect of (Un)Certainty Communication

The main effects of source type are shown in Figure 2, with the index of trust in the message and confidence in vaccine safety as the dependent variable. Full regression models are reported in Appendix B, Table B1. There are at least three takeaways from Figure 2. First, respondents expressed fairly high levels of trust and confidence in vaccine safety irrespective of the source and content of the statement: All predicted mean scores were above the mean on the 1–7 scale. Second, respondents were more likely to trust the statement and vaccine safety if the source was the government or a health expert. This provides support for H2, that messages about vaccines will be more trusted and lead to more confidence in vaccine safety when the source is nonpolitical. Third, the effect of the content of the statement was only statistically significant when the source was the government or a health expert. In these cases, respondents expressed higher levels of trust and confidence in vaccine safety when there was a statement of certainty. However, when the source of the statement was a politician, the content of the message did not matter.
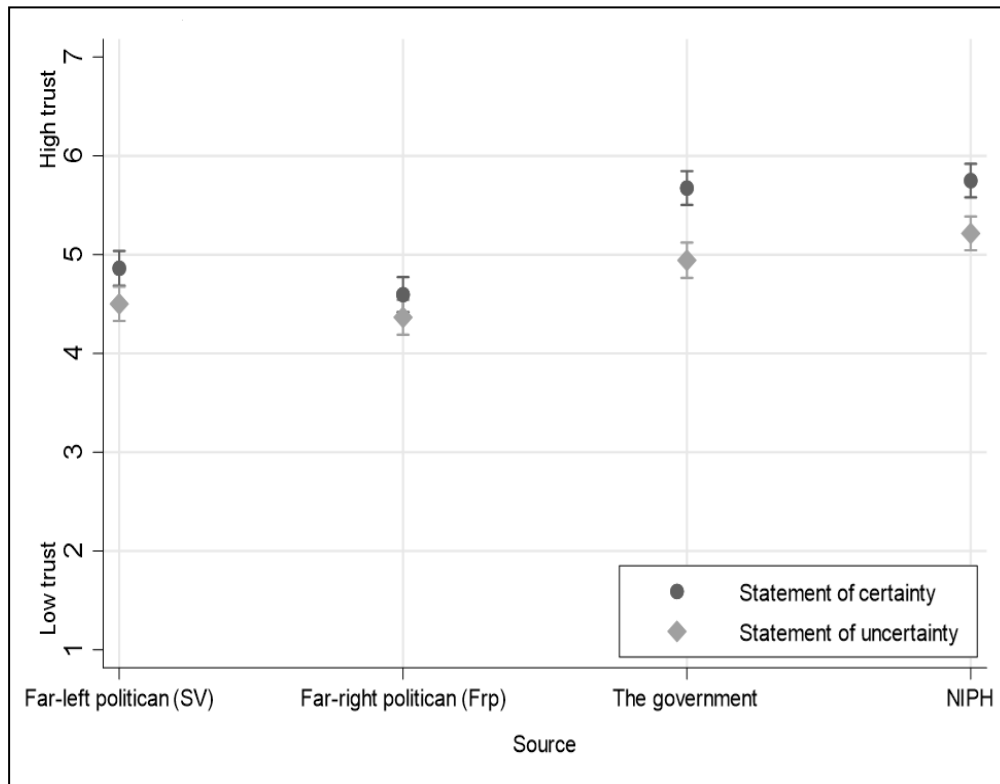

Figure 2. Trust in vaccine communication and confidence in vaccine safety, depending on content of the statement and the source.

Note. Figure 2 shows predicted mean values from ordinary least squares (OLS) regressions, with full regression models in Appendix A, Figure A1.

Separate analyses of each outcome variable suggest that the differences between statements of certainty and uncertainty are the largest on the item measuring confidence that vaccines are safe (see Appendix A Figures A1 and A2). On this outcome, respondents expressed about 1 scale point higher level of confidence when the government or the NIPH delivered a statement of certainty, compared with a statement of uncertainty. On the item measuring trust in the message, there was only a statistically significant effect of the content of the statement (more trust in a statement of certainty) when the source was the government. Across the two outcome variables, there were no statistically significant differences between a statement of certainty and uncertainty when the source was a politician. Thus, in sum, H1a and H2 received conditional support: Hypothesis 1a was supported when the source was apolitical, and mainly when the message was about vaccine confidence. Hypothesis 2 was supported when the source was a pure expert source (NIPH), and partly when the source was the government.

The Effect of Political Preference

Next, we analyzed differential effects related to the participants' own political preferences by including three-way interaction terms between the content of statement (certainty/uncertainty), source (Far-Left politician, Far-Right politician, the government, the NIPH), and political preference (left-wing parties, right-wing parties) in the models. Respondents supporting other parties than those clearly located on the Left or Right, and respondents who did not report political preference, were excluded from this analysis. Full regression models are reported in Appendix B, Table B2, while the results of interest (three-way interaction terms between political preference, source, and content of the message) are plotted in Figure 3.

The results in Figure 3 suggest that political preference mattered for trust in the message and vaccine confidence in expected ways, thus supporting H3. In other words, Left-leaning respondents were more likely to trust messages from a left-wing politician, while Right-leaning respondents were more likely to trust messages from a right-wing politician. There was a tendency for a stronger partisan effect among those supporting left-wing parties, especially when there was a statement of certainty. In this scenario, Left-leaning respondents expressed levels of trust higher than 1 scale point in a statement from a Far-Left politician than from a Far-Right politician. All other "partisan effects" were smaller than 1 scale point. The partisan effects are visible across the two outcome variables, but there is a tendency for a stronger effect on the question of whether respondents would trust the message compared with more confidence in vaccine safety (see Appendix A, Figures A3 and A4).
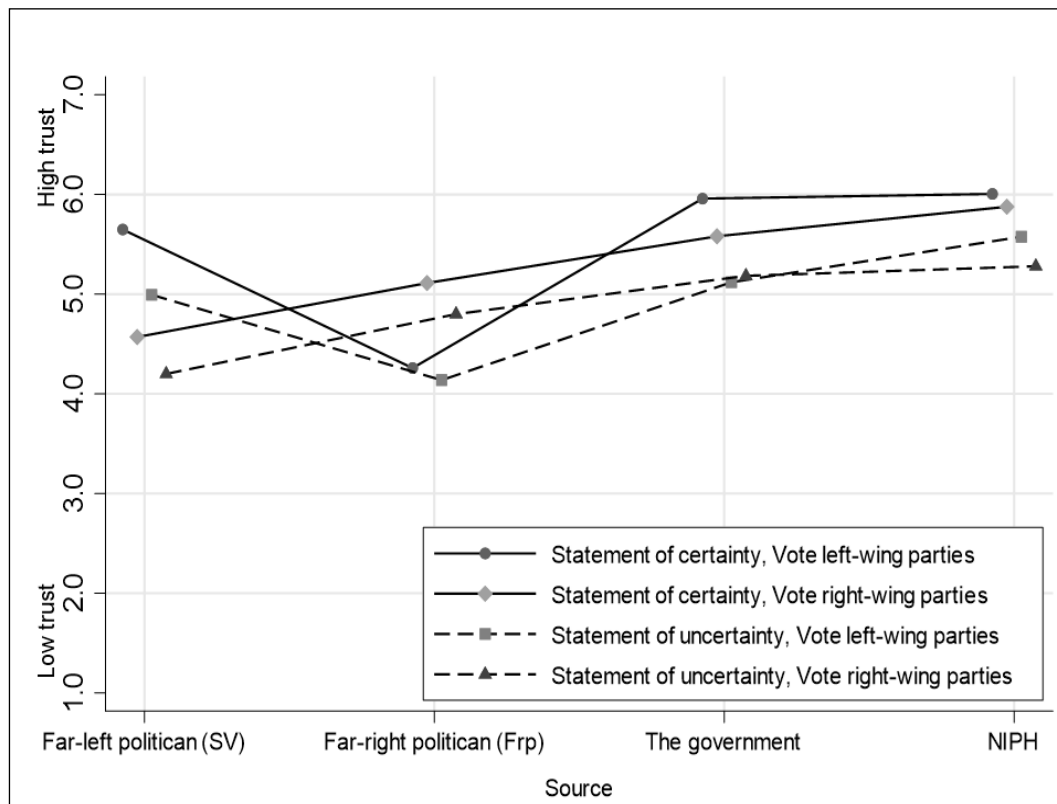
Figure 3. Trust in vaccine communication and confidence in vaccine safety, depending on content of the statement, the source and political preference.

Note. Figure 3 shows predicted mean values from ordinary least squares (OLS) regressions, with full regression models in Appendix A, Figure A3.

Finally, there are small differences between Left-leaning and Right-leaning respondents when considering statements from the government or the NIPH. Those who voted for left-wing parties were more likely than those who voted for a right-wing party to trust a statement of certainty when delivered by the government, and a similar tendency when considering a statement of uncertainty from the NIPH. In sum, however, these results do not provide support for H4, that respondents supporting right-wing parties are less likely to trust statements from public health authorities. It is, however, important to note that, at the time when the survey was fielded, Norway had a center-right government, with a Conservative minister of health, and that trust in the government among right-wing supporters therefore could have been inflated.

To sum up, the results in Figures 1 and 2 provide conditional support for H1a, respondents expressed higher trust in a statement of certainty, but only when the source was apolitical and the message was about vaccine confidence. Hypothesis 1b (higher trust in the statement of uncertainty) was rejected across the board. Hypothesis 2 (more trust in apolitical sources) was largely supported, with the exception

of vaccine confidence when the government expressed a statement of uncertainty. Hypothesis 3 (partisan bias in trust evaluations) was generally supported, while H4 (less trust in expert sources among right-wing respondents) had to be rejected—at least in the case when Norway had a center-right government.

Concluding Discussion

RQ1: Certainty/Uncertainty Statements

The first research question in this study addressed the effect of statements expressing certainty as compared with uncertainty. As pointed out in the introduction, there are conflicting findings regarding whether communication of uncertainty contributes positively to trust, which has led to calls for research that addresses how uncertainty communication can best be executed and under what conditions it is likely to succeed (Balog-Way & McComas, 2020; Driedger et al., 2021; Janssen et al., 2021; Paek & Hove, 2020). The current study was undertaken in Norway, a high-trust society, where transparency about uncertainty has been hypothesized as an important success factor in public evaluations (Norges Offentlige Utredninger, 2021). The experiment analyzed in this article has, however, not provided evidence supporting this claim. Statements of certainty led to trust levels higher than or similar to trust levels in statements of uncertainty, depending on the content and source of the message. This contradicts previous studies showing that transparency about uncertainty increases trust (Brashers, 2001; Gustafson & Rice, 2020; van der Bles et al., 2020).

At the same time, across all treatments levels of trust were generally high, above the mean score in all conditions. This might be attributed to Norway being a high-trust society. Therefore, even though statements of certainty were often perceived as more trustworthy, the findings do not suggest that uncertainty communication was associated with low trust in Norway (Gustafson & Rice, 2020; Guttman & Lev, 2021; Lofstedt & Bouder, 2017). The rather small differences, especially concerning trust in the general vaccine message, certainly do not indicate that the public was overwhelmed (Hanson et al., 2021), disturbed (Maier et al., 2016), or confused (Johnson & Slovic, 1998) by such messages. Our reading is thus that citizens in Norway trust certainty communication more in times of distress; at the same time, there is a high acceptance of uncertainty communication as well.

Considering the two different outcome variables separately, our study indicates that uncertainty may play different roles when the aim is to garner general trust in the communication of a given entity than when the aim is to instigate trust in concrete measures that may require action on the part of citizens, such as accepting the directive to get vaccinated. In the latter situation (more confidence in vaccine safety), respondents clearly preferred statements of certainty from the government and the NIPH. One interpretation of the difference in effects pertaining to the two questions is that the first question triggered the preexisting trust that respondents held for the various actors in handling COVID-19, while the second question spoke to the everyday considerations that citizens were making concerning the safety of vaccines. Given that the experiment was carried out shortly after the Astra Zeneca vaccine was excluded from Norway's vaccination program, the need for reassurance and certainty communication from public authorities may have been particularly strong. The fact that public support for COVID-19 vaccines remained high throughout spring 2021 (Directorate of Health, 2022) might be read as an indicator of the influence of the communication of

the public health authorities and/or as a consequence of the high levels of initial trust. Similar follow-up studies on Norway (or other high-trust countries) are needed to illuminate whether the findings pertaining to certainty versus uncertainty communication are limited to the specific situation in May 2021. If not, one possible explanation would be that citizens in high-trust societies have a higher acceptance of communication of uncertainty from the authorities than do societies with lower levels of trust.

RQ2: Source Type

The second research question of the study focused on source type, considering that previous studies have indicated that experts are trusted to a higher degree than politicians (e.g., Hendriks et al., 2022; Janssen et al., 2021). While the NIPH was trusted to a high degree, it is also interesting that so much trust was placed on the statements from the government, frequently on par with the experts from the NIPH. These observations might reflect the generally high levels of trust in, and the general satisfaction with, the handling of the COVID-19 pandemic in Norway (Christensen & Laegreid, 2020; Norges Offentlige Utredninger, 2021, 2022). As could be expected, politicians from the Far Left and Far Right were trusted the least. But trust was above the mean score on the Likert scale for these sources as well, even among voters of opposing parties, indicating low levels of political polarization on issues related to the pandemic in Norway. The largest difference in effects of certainty/uncertainty was detected in relation to trust in vaccine safety when uttered by the government and the NIPH. For the politicians, the differences were minuscule. Previous studies of polarization in Norway have indicated that it is lower than elsewhere (Knudsen, 2020; Torcal, 2017; Wollebæk, Brekke, & Fladmoe, 2022), which may explain some of this result. Moreover, the political handling of the pandemic was characterized by a relatively broad consensus, and all political parties largely supported the government's containment measures and strongly advocated vaccines.

RQ3: Political Preference

Finally, the third research question sought to shed light on the importance of political preferences in relation to trust. The findings suggest that political preference affected trust levels when the source was a party politician but not when the source was the government or the NIPH. This underscores the limited political polarization on COVID-19 policies in Norway, in contrast to some other countries (see e.g., Cairns et al., 2013; Jones-Jang & Noland, 2022; Nan et al., 2022). Even after controlling for political affiliation, trust in the government and the NIPH remained high in Norway. Surveys also showed high levels of trust in the public health authorities throughout the pandemic (Directorate of Health, 2022). The survey experiment findings thus seem to confirm the impression of Norway as a country with high levels of social and political trust and low levels of political polarization during the pandemic. Our specific results might not hold true in countries with low levels of trust in the public health authorities, where little is done to qualify the uncertainty, and/or health issues are politicized. A study from China (Chen et al., 2022) suggested that uncertainty communication did not play a huge part since the citizens were eager to get vaccinated to return to some kind of normalcy. Again, this points to the importance of context sensitivity and adjusting messages to the audience's prior attitudes (Kelp et al., 2022).

Despite the fact that statements expressing certainty were the most trusted, this type of communication also calls for caution, further analyses of how effects might differ over time (Kelp et al.,

2022), and the strategic possibility of having a "cushion" concerning the uncertainty stemming from contradictions when projections do not hold and advice must be changed (Batteux et al., 2022; Hyland-Wood, Gardner, Leask, & Ecker, 2021; Kreps & Kriner, 2020). In the long term, it might be advisable to combine messages of certainty with carefully crafted messages expressing qualified uncertainty. Messages need to be contextualized to emphasize such aspects as having "the best available knowledge" and the search for more knowledge to reduce the uncertainty (Frewer et al., 2002; Guttman & Lev, 2021; Kjeldsen, Mølster, & Ihlen, 2022). Such carefully crafted messaging would address both the ontological and epistemological uncertainties (Markon & Lemyre, 2012; Markon et al., 2013). Science and research in general revolve around a process of uncertainty and the constant testing of claims and assumptions, and adaptation to new knowledge and situations is an important hallmark. It should also be noted that surveys indicate that public confidence in science increased during the pandemic (Research Council of Norway, 2020; Wellcome Global Monitor, 2020).

Limitations and Future Research

This study has important limitations regarding both methods and the particular context in which it was carried out. Concerning methodology, the perhaps most important limitation in this study is the hypothetical nature of the vignettes, asking respondents whether they trust a fictitious statement and whether that fictitious statement would make them more or less likely to trust vaccines. These statements would perhaps seem even more fictitious when delivered by a party politician. Furthermore, the synchronic and artificial nature of the survey experiment should also lead to some interpretive caution. The possibility of long-term effects cannot be ruled out, and the conclusions must obviously be discussed in relation to other sources and more context-sensitive studies. In addition, the uncertainty surrounding vaccine effectiveness and safety is not influenced only by statements from scientists or politicians; other actors like news media or social media, family or friends, workplaces/employers, as well as for-profit businesses (e.g., pharmaceutical companies) can also play a role here. Likewise, it would be worthwhile to also measure the knowledge, awareness, and vaccine literacy of the respondents, as well as the level of vaccine hesitancy. If, for instance, the public had highly a positive attitude toward the vaccine, then certainty or uncertainty in statements probably did not matter. In short, a survey experiment like the one conducted here is an obvious simplification of a highly complex process.

Concerning context, it is important to emphasize that the study was carried out during a particular period (May 2021), in a particular context (Norway). In May 2021, scientific evidence about COVID-19 vaccines had accumulated to a substantial degree, and vaccination intentions in the general public in Norway had surpassed 90% (Wollebæk, Fladmoe, et al., 2022). Thus, the public was probably highly susceptible to any endorsement of vaccines. This is further corroborated by the generally high levels of trust in Norway, which is likely to ease public communication during times of uncertainty. A hypothesis already mentioned is that certainty works best in a high-trust society where citizens already trust the government and thus have greater confidence in clear and univocal messages. Whether such is the case could obviously be tested further, along with the hypothesis that in a society characterized by high trust, there might be more opportunities to express uncertainty.

Further research could also be conducted to assess the importance of uncertainty communication considering the distrust in elites detected in many countries. While we did not find evidence of these factors in the Norwegian context, a comparative and longitudinal study of these aspects would be particularly welcome. How would uncertainty communication work in contexts of low political and social trust?

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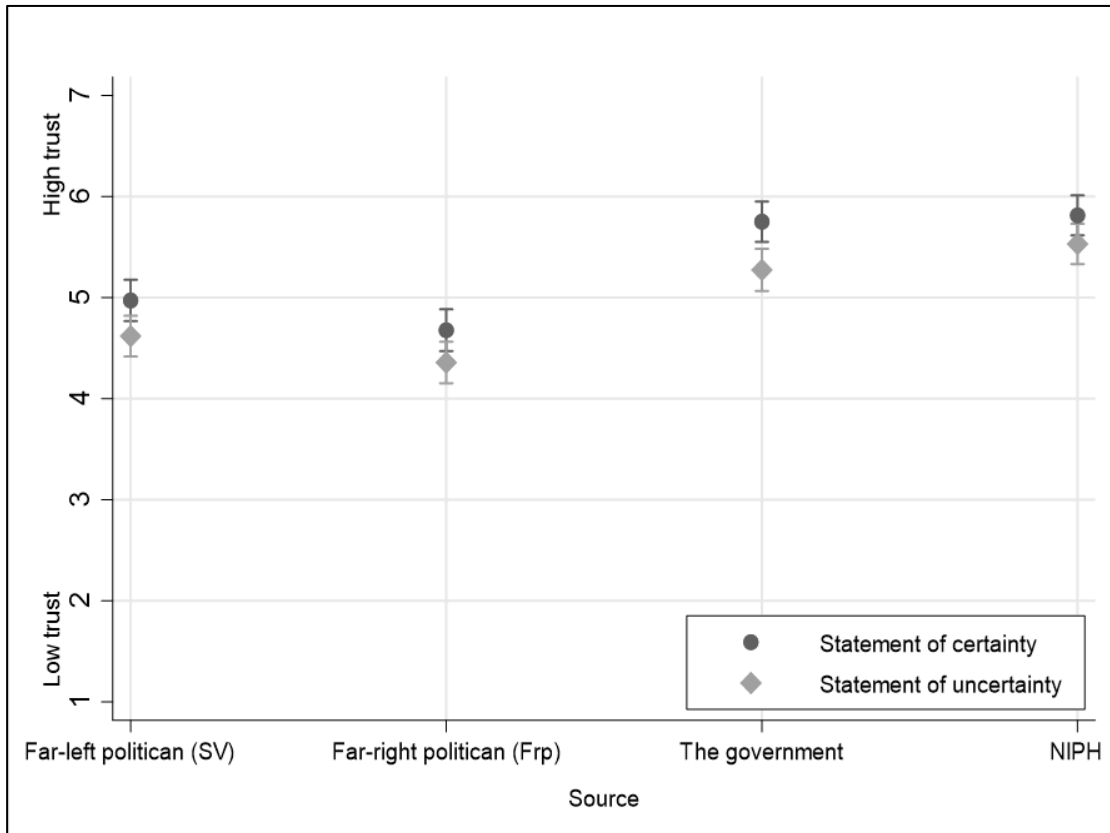
Appendix A

Figure A1. To what extent would you trust this message?

Note. Trust in vaccine message, depending on the content of the statement and the source. Predicted mean values from ordinary least squares (OLS) regressions. SV: Socialist Left Party, FrP: Progress Party, NIPH: National Institute for Public Health.

Statement of certainty: "We are absolutely certain that the vaccines protect against corona-related diseases. Vaccination will also reduce the spread of the infection; researchers are in no doubt." Statement of uncertainty: "We believe that the vaccines protect against corona disease. Vaccination will probably also reduce the spread of infection, but researchers are in doubt as to how much."
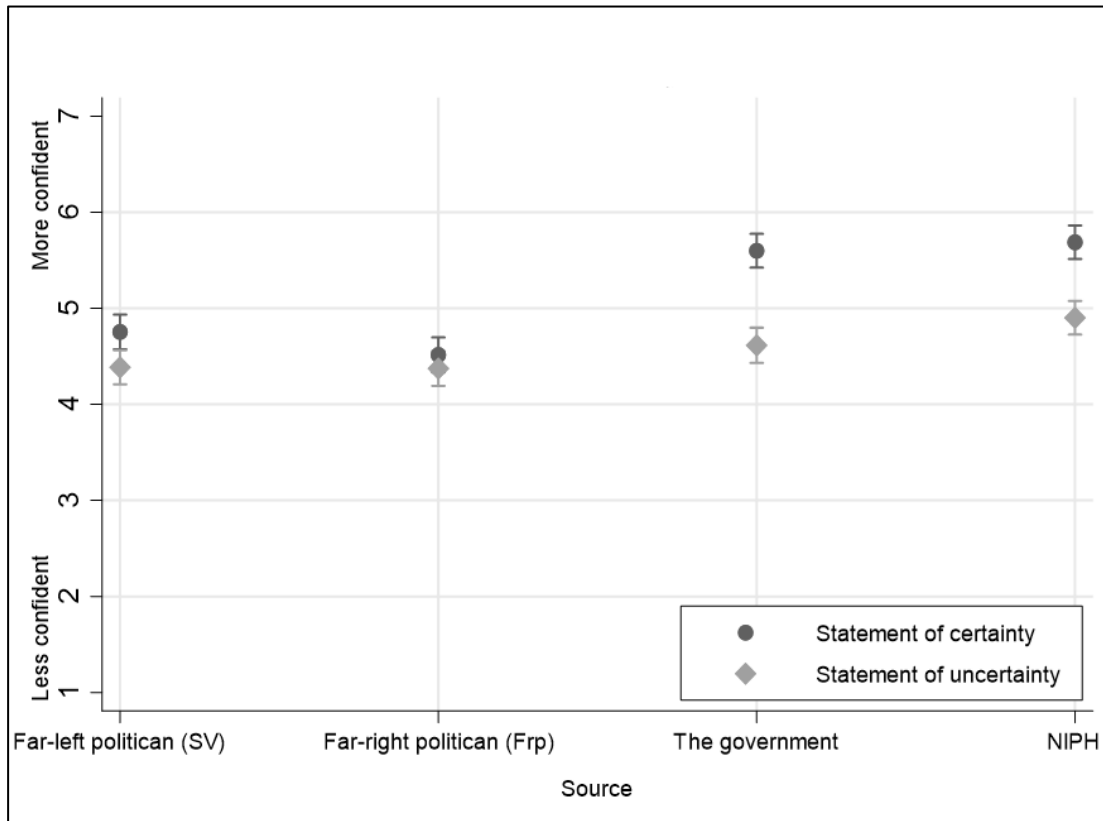
Figure A2. Would this message make you more or less confident that vaccines are safe?
Note. Statement of certainty: "We are absolutely certain that the vaccines protect against corona-related diseases. Vaccination will also reduce the spread of the infection; scientists are in no doubt." Statement of uncertainty: "We believe that the vaccines protect against corona disease. Vaccination will probably also reduce the spread of infection, but scientists are in doubt as to how much."

Figure A3. To what extent would you trust this message?

Note. Trust in vaccine message, depending on the content of the statement, source, and political preference. Predicted mean values from OLS regressions. Statement of certainty: "We are absolutely certain that the vaccines protect against corona-related diseases. Vaccination will also reduce the spread of the infection; researchers are in no doubt." Statement of uncertainty: "We believe that the vaccines protect against corona diseases. Vaccination will probably also reduce the spread of inf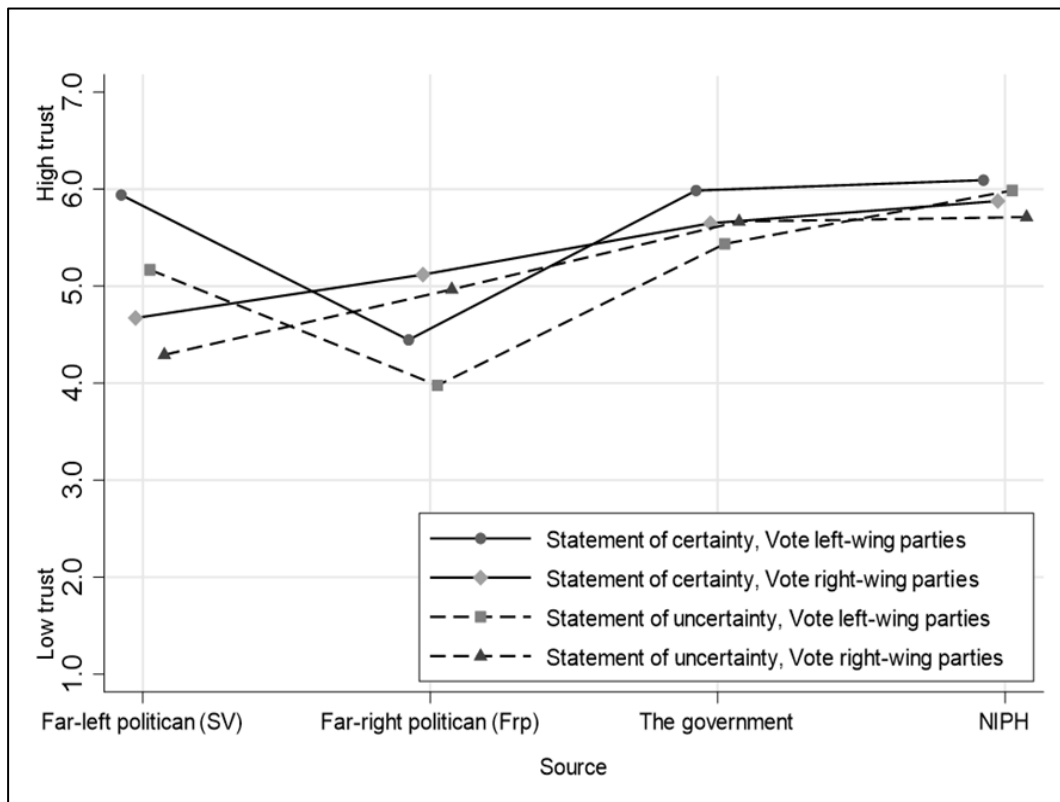ection, but scientists are in doubt as to how much." Left-wing party preference: Red, Socialist Left Party, Labor Party; right-wing party preference: Conservative Party, Progress Party.

Figure A4. Would this message make you more or less confident that vaccines are safe?
Note. Confidence in vaccine safety, depending on the content of the statement, source, and political preference. Predicted mean values from OLS regressions. Statement of certainty: "We are absolutely certain that the vaccines protect against corona-related diseases. Vaccination will also reduce the spread of the infection; scientists are in no doubt." Statement of uncertainty: "We believe that the vaccines protect against corona diseases. Vaccination will probably also reduce the spread of infection, but scientists are in doubt as to how much." Left-wing party preference: Red, Socialist Left Party, Labor Party; right-wing party preference: Conservative Party, Progress Party.
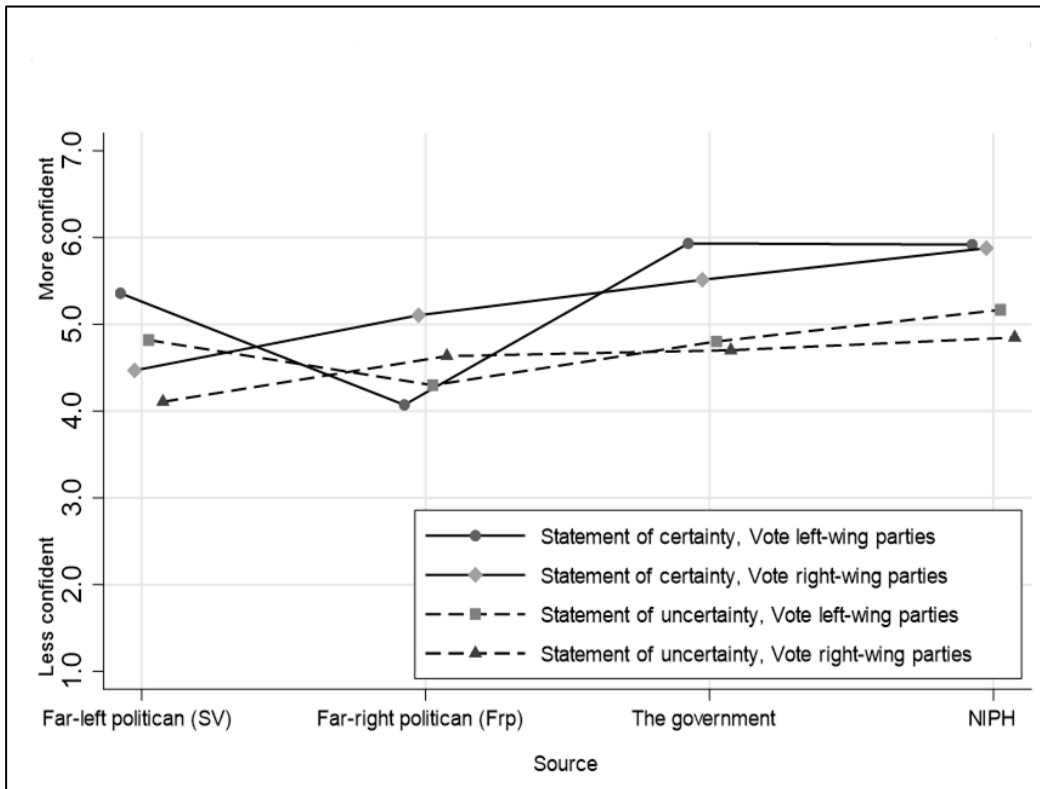
Appendix B

Table B1. Trust in Message and Vaccines, Depending on the Content of the Statement and the Source. OLS Regressions.

	Trust Vaccine Communication and Confidence in Vaccine Safety (Index)		Trust Vaccine Message (Item)		Confidence in Vaccine Safety (Item)	
Content of statement (ref = certainty)						
Statement of uncertainty	−0.360**	−0.412***	−0.353*	−0.404**	−0.368**	−0.419***
Source (ref = Far-Left pol. (SV))						
Far-Right politician (Frp)	−0.267*	−0.328**	−0.294*	−0.363*	−0.239†	−0.293*
The government	0.812***	0.744***	0.779***	0.711***	0.845***	0.777***
The NIPH	0.888***	0.838***	0.842***	0.782***	0.933***	0.894***
INTERACTIONS						
Content of statement × source (ref = certainty × Far-Left pol.)						
Statement of uncertainty × Far-Right politician (Frp)	0.130	0.208	0.033	0.108	0.227	0.308†
Statement of uncertainty × the government	−0.370*	−0.313†	−0.124	−0.078	−0.616***	−0.548**
Statement of uncertainty × the NIPH	−0.174	−0.097	0.07	0.157	−0.418*	−0.352*
Gender (women = 1)		−0.058		−0.065		−0.052
Age		0.006***		0.003		0.010***
Higher education		0.155*		0.293***		0.016
Party preference (ref = Labor)						
Red		−0.102		0.031		−0.235
Socialist Left Party		0.117		0.189		0.046
Centre Party		−0.320**		−0.381**		−0.260*
Green Party		−0.044		−0.103		0.015
Christian Democratic Party		−0.084		−0.03		−0.138
Liberal Party		0.032		0.197		−0.134
Conservative Party		−0.011		0.069		−0.091
Progress Party		−0.387**		−0.349*		−0.425**

Other/NA		−0.476***		−0.496***		−0.457***
Constant	4.863	4.663	4.971	4.888	4.754	4.438
r^2 (adj.)	0.109	0.137	0.09	0.103	0.104	0.118
n	1951	1951	1951	1951	1951	1951

Note. Statement of certainty: "We are absolutely certain that the vaccines protect against corona-related diseases. Vaccination will also reduce the spread of the infection; scientists are in no doubt." Statement of uncertainty: "We believe that the vaccines protect against corona disease. Vaccination will probably also reduce the spread of infection, but scientists are in doubt as to how much."

Table B2. Trust in Message and Vaccines, Depending on the Content of the Statement, Source, and Political Preference. OLS Regressions.

	Trust Vaccine Communication and Confidence in Vaccine Safety (Index)	Trust Vaccine Message (Item)	Confidence in Vaccine Safety (Item)
Content of statement (ref = certainty)			
Statement of uncertainty	−0.656**	−0.771**	−0.540*
Source (ref = Far-Left pol. (SV))			
Far-Right politician (FrP)	−1.390***	−1.495***	−1.286***
The government	0.310	0.046	0.573*
The NIPH	0.357†	0.153	0.560*
Party preference (ref = left-wing parties)			
Prefer right-wing parties	−1.079***	−1.268***	−0.889***
INTERACTIONS			
Content of statement × source (ref = certainty × Far-Left pol.)			
Statement of uncertainty × Far-Right politician (FrP)	0.535†	0.303	0.767*
Statement of uncertainty × the government	−0.183	0.222	−0.589†
Statement of uncertainty × the NIPH	0.226	0.665†	−0.212
Source × party preference (ref = Far-Left pol. × prefer left-wing parties)			
Far-Right politician (Frp) × prefer right-wing parties	1.932***	1.942***	1.922***
The government × prefer right-wing parties	0.701*	0.931**	0.471
The NIPH × prefer right-wing parties	0.950**	1.053**	0.848*
Content of statement × party preference (ref = certainty × prefer left-wing parties)			
Statement of uncertainty × prefer right-wing parties	0.285	0.392	0.179
Content of statement × source × party preference (ref = certainty × Far-Left pol. × prefer left-wing parties)			
Statement of uncertainty × Far-Right politician (Frp) × prefer right-wing parties	−0.476	−0.076	−0.877†

Statement of uncertainty × the government × prefer right-wing parties	0.157	0.176	0.138
Statement of uncertainty × the NIPH × prefer right-wing parties	−0.453	−0.450	−0.456
Constant	5.649	5.940	5.358
r^2 (adj.)	0.179	0.158	0.157
n	1126	1126	1126

Note. Statement of certainty: "We are absolutely certain that the vaccines protect against corona-related diseases. Vaccination will also reduce the spread of the infection; scientists are in no doubt." Statement of uncertainty: "We believe that the vaccines protect against corona disease. Vaccination will probably also reduce the spread of infection, but scientists are in doubt as to how much." Left-wing party preference: Red, Socialist Left Party, Labor Party; right-wing party preference: Conservative Party, Progress Party.