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Short communication

Conditionality of COVID-19 vaccine acceptance in European countries

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ABSTRACT

The COVID-19 vaccine rollout has offered a powerful preventive measure to help control SARS-CoV-2 transmission. Nevertheless, long-standing public hesitation around vaccines heightened concerns that vaccine coverage would not achieve desired public health impacts, particularly in light of more contagious variants. This cross-sectional survey was conducted online just before the European vaccine rollout in December 2020 among 7000 respondents (aged 18–65) in Belgium, France, Germany, Italy, Spain, Sweden, and Ukraine. The survey included open text boxes for fuller explanation of responses. Overall, 56.9% of respondents would accept a COVID-19 vaccine, 19.0% would not, and 24.1% did not know or preferred not to say. By country, between 44% (France) and 66% (Italy) of respondents would accept a COVID-19 vaccine. Respondents expressed conditionality in open responses, voicing concerns about vaccine safety and mistrust of authorities. We highlight lessons learned about the dynamism of vaccine conditionality and persistence of safety concerns.

The COVID-19 vaccine rollout has offered one powerful measure for pandemic control. Enhancing trust and acceptance of these vaccines, as well as equitable access, has remained challenging throughout rollout [1]. Before rollout, several studies in Europe and beyond evaluated whether members of the public would accept a COVID-19 vaccine; projected vaccine uptake figures raised concerns that vaccine coverage would fall short of desired public health impacts, although Europe's COVID-19 coverage has since expanded considerably [2–7].

Vaccine acceptance is a complex, "multi-layered" process [8], influenced by contextual factors [9,10] that include past vaccine experience, shared perceptions of disease severity [11], experiences with the health system [12], and trust in authorities [13]. Approved COVID-19 vaccines have made the decision process even more complex, despite health authorities' efforts to reassure European publics about vaccine efficacy and safety [2]. These concerns are sufficiently complex and dynamic that they cannot easily be distilled into closed questions about projected vaccine acceptance and related factors.

Just before vaccine rollout in Europe, we conducted a mixed-method online study [14], whose primary objective was to estimate self-reported COVID-19 vaccine acceptance in seven European countries and to identify factors associated with vaccine hesitancy. Study results raise lessons for current and future vaccine campaigns.

1. Methods

This cross-sectional survey, conducted by the market research firm Ipsos, sought to estimate expected COVID-19 vaccine acceptance and to evaluate factors associated with vaccine hesitancy. The study was implemented through an online survey from December 4 to 16, 2020 among 7000 respondents in Belgium, France, Germany, Italy, Spain, Sweden, and Ukraine. Following its standard protocol, Ipsos set quotas aligned with nationally representative proportions based on age (18–65), gender, geographical region, and working status for each country. Developing a sample of participants from its existing online research panels, it contacted potential participants by email. Once Ipsos had filled each quota, it closed the quota immediately. In each country, 1000 respondents between 18 and 65 years old participated.

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The following quantitative data were collected among respondents: socio-economic and demographic characteristics; projected COVID-19 vaccine acceptance; trust in sources of medical and scientific information; trust in national, European, and international institutions and authorities, as well as in pharmaceutical companies; perception of vaccine contents, purposes, and safety; and political affiliation.

The survey also collected open text responses from respondents to elaborate results from the core quantitative study, namely whether they would accept COVID-19 vaccination.

All qualitative variables were expressed as percentages. Responses to acceptance of vaccine (yes/no/don't know) were compared using $\chi 2$ test for qualitative variables. A p-value ≤ 0.05 was considered statistically significant. Data were analyzed using STATA Software Version 15.1 (Stata Corporation, College Station, Texas, USA).

NVivo software (Windows Release 1, QSR International) supported the qualitative data analysis. We evaluated 2251 text responses from the French, Italian, and Spanish panels, because vaccine hesitancy and refusal have been prominent in these countries [2] and conducted deductive and inductive coding to develop a thematic analysis of responses.

The University of Antwerp ethics committee provide ethical approval (20/13/150). All participants furnished informed consent before participating in the survey.

2. Results

Table 1 summarizes survey respondent social and demographic profiles. Although respondent panels for each country were representative in terms of age (18–65 years), gender, occupational status, and country region, the panels were heavily weighted towards those with higher than primary-level education.

Fig. 1 shows numbers and percentages of those who would accept or reject vaccination, or who did not know, globally and by country. Overall, 3983 (56.9%) would accept vaccination, 1325 (19.0%) would not, and 1688 (24.1%) did not know or preferred not to say. Survey results showed that projected COVID-19 vaccine acceptance varied across countries, and in some populations would be insufficient to achieve herd immunity, particularly with more contagious variants circulating (Table 2). Between 44% (n = 441, France) and 66% (n = 1658, Italy) of respondents would **accept** a COVID-19 vaccine if it was found by scientific investigation to be safe, effective, and free-of-charge. Between 21% (n = 211, Italy) and 28% (n = 279, France) of respondents did not know or preferred not to say if they would accept a vaccine.

Fig. 1 shows responses by respondents' socio-demographic characteristics. Overall, and in all countries except Italy, women expressed less intention and more uncertainty about accepting a COVID-19 vaccine than men (n = 1820, 51.8%, versus n = 2163, 62.1%, and n = 986, 28% versus n = 700, 20.1% not knowing/preferring not to say). The oldest age cohorts indicated that they were more likely to accept vaccination (45–54 y, n = 952, 58.1%, 55–65 y, n = 907, 62.9%), except for in Italy and Sweden. Married respondents were more likely to accept vaccination (n = 2422, 58.6% versus 1562, 54.5%), except in France and Italy; respondents with higher educational levels (n = 1997, 60.8%) (except in Spain) and those working (n = 2629, 57.8%) (except in Spain) were more likely to accept vaccination.

Analysis of factors associated with vaccine hesitancy focused on the safety and purported contents of the vaccine itself (Table 2). COVID-19 vaccine safety and purported contents were significant factors correlating with projected acceptance, refusal, and not knowing. Across the seven countries, among the 3985 respondents who would accept a vaccine, 53.7% (n = 2140) believed that COVID vaccines "would not be dangerous", compared to 216 (16.3%) among the 1327 respondents who would not accept vaccination. Among respondents who would reject a COVID-19 vaccine, 54.5% believed that safety considerations had been bypassed in vaccine development, and 42.8% claimed that adjuvants were "dangerous to human health", compared to 35.3% and 16.8%, respectively, among those who would accept vaccination. Among respondents who would not accept vaccination, 25.5% believed that authorities wanted to insert "microchips" in COVID-19 vaccinations to control European populations; yet up to 11.3% of respondents believing in this objective would nevertheless accept a COVID-19 vaccine.

Intentions to accept a COVID-19 vaccine were strongly correlated with respondents' trust in their national governments (45.8% accepting vaccination, versus 18.0% rejecting and 22.5% not knowing or saying) and in pharmaceutical companies (46.9%

Table 1
Characteristics of study population.

	Total N (%)	Belgium N (%)	France N (%)	Germany N (%)	Italy N (%)
Women	3 516 (50.3)	498 (49.8)	511 (51.2)	497 (49.9)	504 (50.4)
Age					
18–24	916 (13.1)	132 (13.2)	134 (13.4)	114 (11.4)	110 (11.0)
25–34	1 455 (20.8)	206 (20.6)	200 (20.0)	192 (19.2)	187 (18.7)
35–44	1 546 (22.1)	215 (21.5)	218 (21.8)	209 (20.9)	248 (24.8)
45–54	1 640 (23.4)	233 (23.3)	224 (22.4)	259 (25.9)	243 (24.3)
55–65	1 443 (20.6)	214 (21.4)	224 (22.4)	226 (22.6)	212 (21.2)
Marital status					
Single	2 866 (40.9)	448 (44.8)	373 (37.3)	488 (48.8)	426 (42.6)
Married/Domestic Partner	4 134 (59.1)	552 (55.2)	627 (62.7)	512 (51.2)	574 (57.4)
Employment					
Working*	4 548 (65.0)	641 (64.1)	661 (66.1)	746 (74.6)	568 (56.8)
Not working	2 452 (35.0)	359 (35.9)	339 (33.9)	254 (25.4)	435 (43.5)
Education					
Primary	479 (6.8)	126 (12.6)	5 (0.5)	37 (3.7)	81 (8.1)
Secondary	3 234 (46.2)	350 (35.0)	412 (41.2)	612 (61.2)	669 (66.9)
Tertiary	3 287 (47.0)	524 (52.4)	583 (58.3)	351 (35.1)	250 (25.0)

	Spain N (%)	Sweden N (%)	Ukraine N (%)
Women	498 (49.8)	507 (50.7)	501 (50.1)
Age			
18–24	108 (10.8)	157 (15.7)	161 (16.1)
25–34	212 (21.2)	214 (21.4)	244 (24.4)
35–44	261 (26.1)	180 (18.0)	215 (21.5)
45–54	229 (22.9)	225 (22.5)	227 (22.7)
55–65	190 (19.0)	224 (22.4)	153 (15.3)
Marital status			
Single	394 (39.4)	399 (39.9)	338 (33.8)
Married/Domestic Partner	606 (60.6)	601 (60.1)	662 (66.2)
Employment			
Working*	565 (56.5)	756 (75.6)	611 (61.1)
Not working	435 (43.5)	244 (24.4)	389 (38.9)
Education			
Primary	106 (10.6)	72 (7.2)	52 (5.2)
Secondary	238 (23.8)	549 (54.9)	404 (40.4)
Tertiary	656 (65.6)	379 (37.9)	544 (54.4)

*Defined as full-time employment, part-time employment or self-employment.

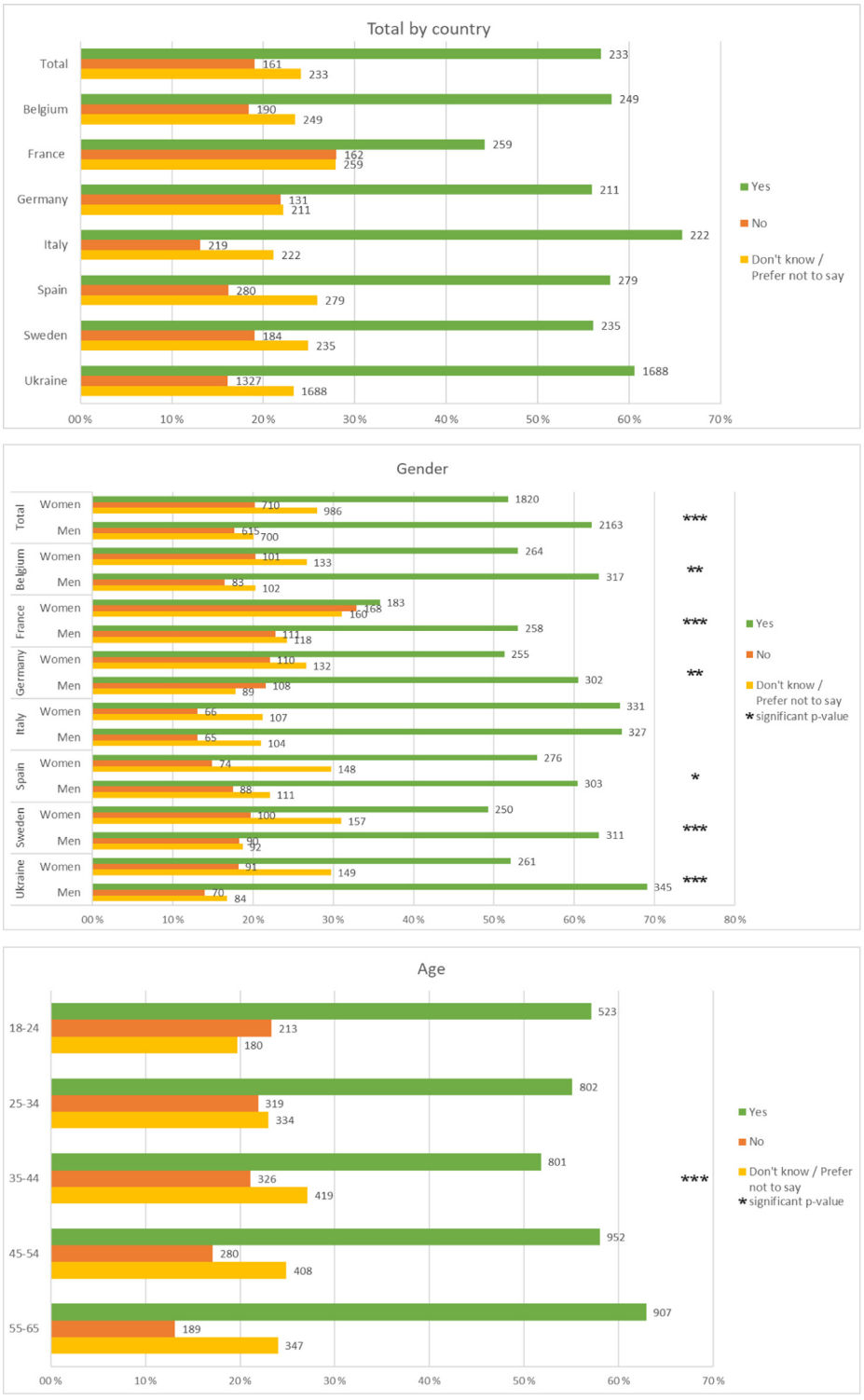

Fig. 1. Vaccine acceptance by socio-demographic characteristics.

accepting vaccination, versus 17.5% rejecting and 22.9% not knowing or saying). In addition, projected vaccine acceptance was also strongly linked to trust in physicians (85.7% (n = 3414) accepting, 62.6% (n = 830) rejecting, and 75.5% (n = 1274) not knowing or saying), in nurses (75.1% (n = 2992) accepting, 57.9% (n = 768) rejecting, 67.9% (n = 1146) not knowing or saying), and in pharmacists (71.2% (n = 2837) accepting, 49.1% (n = 652) rejecting, and 59.8% (n = 1010) not knowing or saying) as sources of medical information. Respondents who identified their political affiliation as "left" were more likely to accept vaccination than those who identified with the "right" or those not responding to the question (66.3% versus 59.0% and 41.8%, respectively).

Qualitative data collected through this survey revealed further insight into why respondents would accept or reject a vaccine. Those who would accept a vaccine indicated that it would confer individual, familial and societal protection and restore daily life

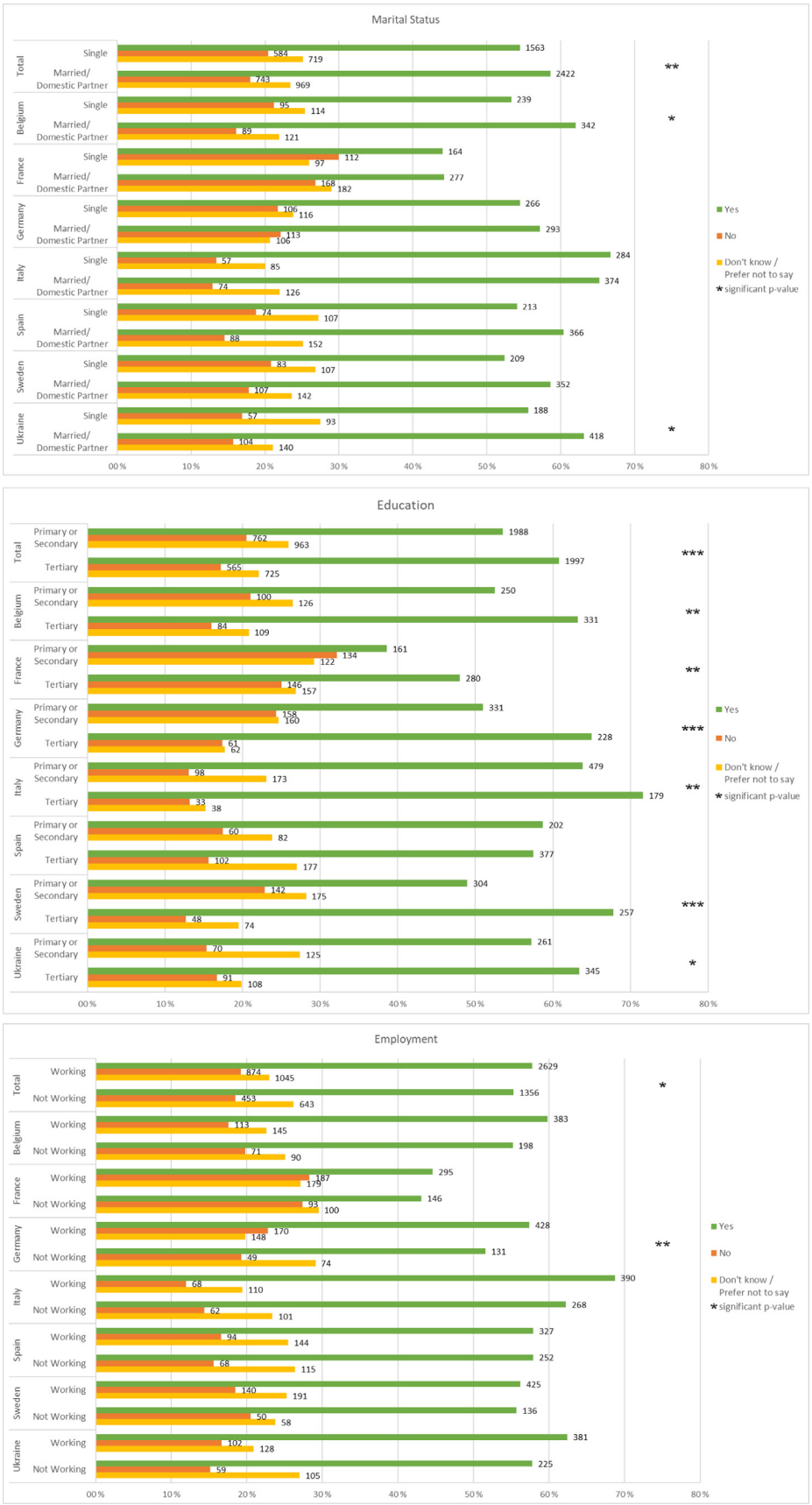

Fig. 1 (*continued*)

Table 2
Factors linked to accepting or rejecting COVID-19 vaccination: n (%).

	Yes (N = 3 985)	No (N = 1 327)	Don't know/Prefer not to say (N = 1 688)	Total _(N = 7 000)	p-value
COVID-19 vaccine					
Vaccine not Dangerous[1]	2 140 (53.7)	216 (16.3)	323 (19.1)	2 679 (38.3)	p < 0.001
Safety considerations Bypassed[2]	1 408 (35.3)	723 (54.5)	766 (45.4)	2 897 (41.4)	p < 0.001
Adjuvants unsafe[3]	670 (16.8)	568 (42.8)	402 (23.8)	1 640 (23.4)	p < 0.001
Microchips in vaccine[4]					
Agree	452 (11.3)	338 (25.5)	191 (11.3)	981 (14.0)	p < 0.001
Trust in					
National government[5]	1 823 (45.8)	239 (18.0)	379 (22.5)	2 441 (34.9)	p < 0.001
Pharmaceutical cos.[6]	1 868 (46.9)	232 (17.5)	386 (22.9)	2 486 (35.5)	p < 0.001
Physicians[7]	3 414 (85.7)	830 (62.6)	1 274 (75.5)	5 518 (78.8)	p < 0.001
Nurses[7]	2 992 (75.1)	768 (57.9)	1 146 (67.9)	4 906 (70.1)	p < 0.001
Pharmacists[7]	2 837 (71.2)	652 (49.1)	1 010 (59.8)	4 499 (64.3)	p < 0.001
Media (general)[7]	2 093 (52.5)	385 (29.0)	613 (36.3)	3 091 (44.2)	p < 0.001
Friends and Family[7]	1 024 (25.7)	344 (25.9)	379 (22.5)	1 747 (25.0)	p < 0.024
Social networks[7]	536 (13.5)	175 (13.2)	187 (11.1)	898 (12.8)	p < 0.046
Political affiliation[8]					
Left	642 (66.3)	146 (15.1)	181 (18.7)	969 (13.8)	
Center	1 814 (60.0)	527 (17.4)	684 (22.6)	3025 (43.2)	p < 0.001
Right	936 (59.0)	341 (21.5)	310 (19.5)	1587 (22.7)	
NA*	593 (41.8)	313 (22.1)	513 (36.2)	1419 (20.3)	

[1] Respondents were asked to what extent they agreed or disagreed with the following claim: "A COVID-19 vaccine will not be dangerous to human health."
[2] Respondents were asked to what extent they agreed or disagreed with the following claim: "I believe that safety considerations are being bypassed in the development of COVID-19 vaccinations."
[3] Respondents were asked to what extent they agreed or disagreed with the following: "Adjuvants (ingredients which cause more antibodies to be produced), contained in most vaccines, have negative effects on human health."
[4] Respondents were asked to what extent they agreed or disagreed with the following: "Authorities want to insert microchips in the COVID-19 vaccine to impose control over people."
[5] Respondents were asked to what extent they agreed or disagreed with the following: "The national government is **being honest** with its citizens when managing COVID-19 pandemic."
[6] Respondents were asked to what extent they agreed or disagreed with the following: "Pharmaceutical companies that are doing research on COVID-19 would be **honest** about what they discover."
[7] The following 6 categories were those in whom respondents trusted (or not) as specific sources of information. Respondents were specifically asked to evaluate "To what extent do you consider the following to be trustworthy, or not, as sources of information about **scientific studies** concerning the origins, treatment, prevention, or consequences of COVID-19?"
[8] Respondents were asked to place their political beliefs on a 10-point scale from left to right.
* NA = Missing data.

and economic activity. One respondent explained that vaccination was essential, noting, "I think this disease is terrible. It has taken away our freedom to live as we did before. We need to regain our freedom and our joy of living." Those maintaining that they would refuse vaccination claimed that it was unnecessary: they did not believe they were at risk for COVID-19, took other health precautions, or thought that viral mutations would render a vaccine useless and unnecessary. "COVID is a virus that mutates all the time," observed another respondent, "which will probably render any vaccine that I receive useless."

Most important, our qualitative analysis showed that projected COVID-19 vaccine acceptance and refusal were conditional. Respondents intending to accept vaccination claimed that they would only do so if it was proven to be safe, which took considerable time to demonstrate. "If a real scientific study indicated that it was effective and certain," one noted, "I see no reason not to accept it. But for such a study to be done, you need time: you can't know in less than one year what the undesirable effects could be." Another respondent planning to accept vaccination nonetheless expressed uncertainty about safety because of rapid vaccine development: "If I knew that it is effective and safe, but the problem is that I cannot know, because we do not know anything and they have to spend years, they have to experiment with us."

Qualitative data also showed that those intending to refuse COVID-19 vaccination similarly worried about safety, rapid vaccine development, and side-effects, and their projected refusals were conditional. "I'm too afraid to get a new COVID vaccine," observed one respondent. "I prefer to wait a bit." Some 40% of those refusing in France, 18% in Italy and 28% in Spain acknowledged that they might later accept but would "let others get vaccinated first".

These open responses revealed deep concerns about pharmaceutical companies and national governments. "I have no confidence in pharmaceutical laboratories," a respondent claimed, whereas another contended that these companies have "too many secrets about vaccine ingredients, there's what's written, and then what the ingredients really are."

3. Discussion

Collected just before Europe's COVID-19 vaccine rollout, this survey in seven European countries showed that up to 66% of respondents anticipated accepting a COVID-19 vaccine, raising concerns that coverage in certain countries and among certain groups would not be sufficiently high to achieve herd immunity [15,16]. COVID-19 vaccines have been shown to be effective with more infectious variants, although some commentators have urged investment in other control strategies and health system strengthening [17–19]. Our results echoed other projections of vaccine acceptance in Europe [2,20,21] and paralleled prior theorizations around vaccine confidence, which is closely linked to trust in the vaccine itself, in vaccine producers, and in the health and political structures that promulgate vaccines [9,10].

Our findings indicated that percentages of people reporting vaccine acceptance shed insufficient light on vaccine hesitancy: understanding reasons behind vaccine uptake decisions is essential for such insight, and ultimately for improving current and future vaccine uptake. The rapid development and purported content of COVID-19 vaccines (e.g. microchips, toxins) and their safety was subject to considerable questioning in our survey, particularly in open text responses, where many respondents conditioned their

acceptance and rejection upon evidence of vaccine safety [22]. Such questioning may have reflected citizens' misgivings about their governments and pharmaceutical companies [8,23]. Both correlations between projected vaccine acceptance and trust in these authorities and open text responses illustrated these misgivings. Moreover, our qualitative evidence emphasized the importance of broad social benefits of accepting COVID-19 vaccination, echoing results elsewhere [24].

Although conducted in late 2020, our study provides an important snapshot of European attitudes toward COVID vaccines. It offers two critical lessons for current and future vaccination campaigns. As of October 2021, EU/EEA states fully vaccinated 74% of adults over 18 years, with EU states in our survey achieving between 81.6% (Germany) and 93.8% (France) coverage; Ukraine's coverage figures, although unavailable, appear low because of delayed vaccine deliveries, high vaccine prices, and mistrust [7,25]. Hence, conditional acceptance or rejection of COVID-19 vaccines has been "volatile", but the "vaccine hesitant" can indeed be convinced [26]. Several measures may have contributed to vaccine acceptance but require further study: making vaccines easily accessible and free-of-charge; addressing rapid vaccine development and safety concerns; and implementing vaccine "passports", although this measure's ethical implications are debated [27–29].

Second, although the proportion of Europe's "hesitating" adult population vaccination has shrunk, vaccine rumors display remarkable continuity. This observation clearly requires further investigation in Europe, but despite communications campaigns, Swedish, Italian, Canadian and American publics, for instance, still express safety consequences of rapid vaccine development [30]. Deeper qualitative inquiries into persistent vaccine concerns and populations adhering to them can contribute to developing targeted, compassionate, non-stigmatizing communications with the persistently hesitant, to help them to make informed decisions.

Our analysis has three limitations. Survey panels select representative samples among age and gender groups, regions, and working status, but are not fully representative because they draw heavily from those with internet access and of higher educational achievements. Second, the panels did not include individuals over age 65. The younger profile of respondents may have biased results toward more vaccine-hesitancy, since younger respondents may perceive themselves as less susceptible to COVID-19. Finally, the survey was conducted in December 2020, providing a past snapshot of attitudes toward COVID-19 vaccines.

4. Conclusion

With varying success, European public health agencies have tackled COVID vaccine safety concerns to assist publics in making informed choices. Vaccine conditionality can be changed. Yet despite campaigns to enhance vaccine confidence and administer doses, the concerns collected before vaccine rollout and reported here persist. More qualitative research can yield deeper understanding of persistent concerns and those embracing them, potentially leading to new interventions that foster more effective exchanges with persistently vaccine-hesitant groups.

5. Authors' contributions

LH, MV, BL, NT, and TG-V analyzed the data. TG-V drafted the comment. All authors read, commented on, and added language to the article.

6. Data Statement

Data can be requested from the RECOVER project.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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