Let's talk about COVID-19 vaccination: Relevance of conversations about COVID-19 vaccination and information sources on vaccination intention in Switzerland

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ARTICLE INFO

ABSTRACT

Background: COVID-19 vaccine hesitancy is known to be more pronounced among young people. However, there are a lack of studies examining determinants of COVID-19 vaccination intention in the general population in this young age-group in Switzerland, and in particular, studies investigating the influence of information sources and social networks on vaccination intention are missing.
Methods: The cross-sectional study "COVIDisc – Discussion with young people about the corona pandemic" provided the opportunity to investigate COVID-19 vaccination intention in 893 individuals aged 15–34 years from the cantons of Zurich, Thurgau, and Ticino in Switzerland. An online survey was administered between 10 November 2020 and 5 January 2021. Associations of public information sources and conversations about COVID-19 with COVID-19 vaccination intention were analyzed with multivariable logistic regression and mediation analysis using generalized structural equation modeling.
Results: 51.5% of the participants intended or probably intended to get vaccinated once the vaccine would be available. Using print or online news (AOR 1.50, 95% CI 1.09–2.07) as an information source and having conversations about the COVID-19 vaccine (AOR 2.09, 95% CI 1.52–2.87) increased participants' COVID-19 vaccination intention. The effects of female gender (b = −0.267, p = 0.039) and risk perception (b = 0.163, p = 0.028) were partially mediated by having conversations about the COVID-19 vaccine. The effects of age (b = −0.036, p = 0.016), secondary educational level (b = 0.541, p = 0.010) and tertiary educational level (b = 0.726, p = 0.006) were fully mediated via having conversations about the COVID-19 vaccine.
Conclusions: Conversations and campaigns should start even before vaccines become available. Our data support interventions for young women and less educated people using social norms and supporting information seeking with news. Trust and risk perceptions are essential foundations for vaccine intentions.

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1. Introduction

COVID-19 vaccines demonstrate satisfactory effectiveness against severe disease, hospitalization, and deaths. Nevertheless, there is a high level of skepticism about COVID-19 vaccination, and a significant proportion of the world population is unvaccinated. In Switzerland, for example, 91% of people over 65 are fully vaccinated, but only 49% of 10–19-year-olds, 71% of 20–29-year-olds and 73% of 30–39-year-olds [1]. Younger people seem to be more COVID-19 vaccine-skeptical than older people [2,3]. For adults, hesitancy towards COVID-19 vaccines has been partly explained by its quick development coupled with the lack of longitudinal data to illustrate long-term side effects [4,5].

Vaccine hesitancy has been a public health issue for as long as there have been vaccines. In 2019, the World Health Organization (WHO) listed vaccine hesitancy as one of top ten threats to global health [6]. Reasons behind hesitancy are complex, context-specific, varying across time, place, and vaccine [7]. Regarding COVID-19 vaccination, numerous studies have demonstrated that individual determinants are gender [8–12], educational level [13–19], health literacy [20–23], and psychological factors (e.g., perceived risk, trust in science) [8–11].

Additionally, information sources play a pivotal role in shaping public opinion and thus contribute to vaccine hesitancy [24]. Lee and Lou [24], for example, found that the use of offline media, i.e., listening to the radio and reading newspapers, is positively associated with vaccination intention. In contrast, people who mainly use social media or webpages as information sources express higher negative vaccination intention [25]. A systematic review shows that negative effects of social media, such as the spread of misinformation, override positive ones with regard to vaccination willingness [26].

Attitudes towards vaccines are likely to be influenced not only by individual characteristics but also by the people around them [27]. According to Brewer et al. [28], social networks play an important role in vaccination attitudes and behavior. People discuss their vaccination attitudes with their social network, thereby making vaccination decisions a part of their social identity [28]. According to social contagion theory [29,30], a person's attitudes and behavior can be contagious to others in their social networks [31]. Thus, people tend to adapt their actions to the behavior and expectations of others and may imitate the vaccination behavior of others [28].

To date, vaccine hesitancy has been widely studied in the general adult population and parents. Young adults, however, have been under-investigated. While Dratva et al. [32] investigated COVID-19 vaccination intention among Swiss students, Zürcher et al. [33] among health care workers and Wagner et al. [34] among parents, there are a lack of studies examining determinants of COVID-19 vaccination intention in the younger general population in Switzerland, and studies investigating the influence of information sources and social networks on vaccination intention.

Therefore, the aim of this study was to investigate the hypotheses that public COVID-19 information sources as well as conversations about COVID-19 with family and friends are directly associated with COVID-19 vaccination intention (H1) and that they act as mediators – at least partially – in the relationship between individual determinants and COVID-19 vaccination intention (H2).

2. Material and methods

2.1. Study design and data

Study data come from the cross-sectional study "COVIDisc – Discussion with young people about the corona pandemic" [35],

which investigated the public communication concerning COVID-19 and its perception.

People aged 15–34 years living in the cantons of Zurich, Thurgau, and Ticino (N = 3,597) were invited by postal letter to participate in an online survey between November 10, 2020 and January 5, 2021. The random representative sample was drawn by the Federal Statistical Office (FSO). The selection of cantons was based on the COVID-19 case numbers in the first pandemic wave. Canton Ticino was profoundly hit by COVID-19 in the first wave and Canton Zurich had the highest infection rates for the German-speaking part of Switzerland, but on a much lower level than Ticino. In contrast, Canton Thurgau had very few cases during the first wave.

The study is in accordance with the Declaration of Helsinki and was submitted to the Cantonal Ethics Committee of the Canton of Zurich, Switzerland. It does not fall under the Human Research Act and an exemption of an ethical review was received (BASEC-Nr. Req-2020-01081). All participants provided informed consent before starting the survey. This manuscript was prepared in compliance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist [36].

2.2. Survey instrument

The 44 items of the online survey (see supplement 1) were developed by the interdisciplinary COVIDisc study team. Validated items were used when possible. Professional translators translated the basic English version into German and Italian. The items were programmed in the Qualtrics survey tool (Qualtrics, Provo, UT, USA) and adjusted after 5 young persons for each of languages pretested the survey.

Participants accessed the survey with an individual study code. This allowed us to link survey data with socio-demographic data provided by the FSO.

2.3. Missing data

922 (26%) of 3,597 people invited completed the survey. 29 participants (0.8%) were excluded, because of missing socio-demographics (n = 7) or missing information sources (n = 22), resulting in 893 study participants.

Information on COVID-19 vaccination intention, our primary outcome, was provided by n = 860 respondents (96.3%). The analytic sample consists of data sets with complete data for all variables (n = 857 respondents, 96.0%). We used the Stata *mdesc* and *mvpatterns* commands to assess incomplete cases. We detected no systematic patterns in the missing data. Missing values of individual variables lay between 0% and 3.7%.

2.4. Measures

2.4.1. Outcome: COVID-19 vaccination intention

The outcome variable was COVID-19 vaccination intention, measured with a single item used in the HES-C study [37] and the Swiss national Corona Immunitas Study [15]. Respondents were asked: "When/if a vaccine becomes available for COVID-19, do you think you will take it?", using a 6-point Likert scale (no/ probably no/ undecided/ yes, after others/ probably yes/ yes). For the analysis, the responses were dichotomized into "low vaccination intention" ("no/ probably no/ undecided) and "strong vaccination intention" (yes/ probably yes/ yes, after others).

2.4.2. Predictors

Participants were asked which three information sources they primarily used to acquire information about the coronavirus (not used/ used) [38]. We included six public sources of information: television (e.g., news, documentary), 2) news: newspaper (online

or print) or news portal, 3) social media, 4) official health hotlines, 5) official health websites and 6) other websites (e.g., university, NGO's, non-specific pages).

Participants were also asked which topics related to COVID-19 they mainly discuss with family and friends (not discussed/discussed), of which three topics were included in the analyses: personal risk of getting infected, risk of infecting others, and COVID-19 vaccination development and availability.

2.4.3. Covariates

Risk perception was measured with two items rated on a 5-point Likert scale (from "not at all worried" to "extremely worried"): 1) worry of the risk of getting the virus, and 2) worry about the risk of distributing the virus to others. The single scores were added up and divided by two for a combined risk perception value ranging from 1 to 5 with higher values representing higher risk perception.

Trust in 1) scientists, 2) the federal government (federal council), and 3) the cantonal government was measured with a 5-point Likert scale (from "no trust at all" to "a great deal of trust"). These questions were combined to a trust score again ranging from 1 to 5 with higher values representing higher trust.

Health literacy was assessed with the appraisal subscale of the Coronavirus-Related Health Literacy measure (HLS-COVID-Q22) [39]. The appraisal subscale comprises five items rated on a 5-point Likert scale (from "very difficult" to "very easy") which assesses competencies to critically appraise health information [39]. The five items were summed up to a score ranging from 5 (low health literacy) to 25 (high health literacy).

Sociodemographics included age, gender, last educational degree obtained (primary level: elementary school, middle school/secondary level: high school, vocational school/ tertiary level: university, postgraduate Diploma), born and raised in Switzerland (yes/no), and Canton of residence (Thurgau/ Ticino/ Zurich).

2.5. Statistical analyses

Descriptive sample statistics were run and univariate t-tests and Chi-square-tests were used to assess univariate group differences. Multivariable logistic regression models were applied to estimate the association of information sources and discussion topics with COVID-19 vaccination intention. In a first model, we included the information sources adjusted for socio-demographic covariates. Further models were adjusted for conversation topics (model 2) and risk perception as well as trust (model 3, full model). We report adjusted odds ratios (AOR) with corresponding 95% confidence intervals (95% CI) for the predictors and the model covariates. Statistical significance was established at $p < 0.05$.

A mediation analysis using generalized structural equation modeling (GSEM) was performed to investigate the association and pathways between information sources and conversation topics and vaccination intention in the multivariable logistic regression model (full model). The mediation models included all plausible pathways between independent and dependent variables. The significant relationships of the final models were plotted in a path diagram, with red lines denoting negative associations between variables and green lines denoting positive associations.

We used Stata version 15.1 (StataCorp, College Station, TX, USA) for statistical analyses.

3. Results

3.1. Participant characteristics

The analytic sample consists of 857 individuals, 481 women (56.1%) and 376 men (43.8%), with a mean age of 22.9 years (SD 5.8) (Table 1). 82% were born and raised in Switzerland, around three-fifths lived in the canton of Ticino, and one-fifth each in the cantons of Thurgau and Zurich. A third (32.6%) indicated that their last educational qualification obtained was a tertiary level qualification, 50.1% a secondary level qualification and 17.4% a primary level qualification. On a scale of 5 to 25, the Coronavirus-related health literacy was a mean of 16.8 (SD 3.6). Men's health literacy was significantly higher than of women (17.2 vs. 16.5, $p = 0.005$).

Regarding sources used to acquire information about COVID-19, respondents most frequently mentioned news, television, and official health websites. Less frequently mentioned were social media, other websites, and official health hotlines. There were significant gender differences regarding official health hotlines ($p = 0.016$) and other websites ($p < 0.001$). While the former was used more often by women to acquire information, the latter was used more often by men.

The COVID-19 pandemic was a topic of discussion among participants: While 36.2% discussed the risk of getting infected, 43.9% talked about the risk of infecting others. The development and availability of the vaccine were addressed by 35.5%. A significant gender difference was observed in the risk of infecting others, with women discussing this topic more often ($p < 0.001$).

Trust in government and science was generally high among the respondents with a mean value of 3.5 (SD 0.8) on a 5-point scale. Also, risk perception, i.e., getting or transmitting SARS-CoV-2, was rather high with a mean value of 2.9 (SD 0.9) on a 5-point scale. Women were significantly more concerned than men (2.7 vs. 3.1, $p < 0.001$).

Overall, 51.5% of the participants expressed intention to get vaccinated ("yes", "probably yes", "yes after others"). Vaccination intention was lower in women than in men ($p = 0.063$). 14.1% indicated that they would get vaccinated against COVID-19 ("yes") and 12.8% responded they would not ("no"). Three-fourths were not absolutely sure ("probably yes" 17.4%, "probably no" 15.8%), undecided (20.0%), or wished to wait for others to vaccinate first (20.0%).

3.2. Factors associated with COVID-19 vaccination intention

Table 2 shows the results of the multivariable logistic regression models (for unadjusted OR see supplement 2, Table S1). In the first model (Model 1), all of the information sources adjusted for sociodemographic factors were positively and significantly associated with vaccination intention, with exception of "official health hotlines".

In the second model (Model 2), including predictor variables "conversation topics" showed an attenuation of the effect of the information sources: "social media", "official health websites" and "other websites" turned borderline significant, while "television" and "news" remained statistically significant. The conversation topics "getting infected", "infecting others" and "vaccine development" were positively and significantly associated with vaccination intention.

In the full model (Model 3), adjusting for the two covariates "risk perception" and "trust" led to a further attenuation of the effect and significance level of both the information sources as well as conversation topics. Only "news" (AOR 1.50, 95% CI 1.09–2.07) and "vaccination development and availability" (AOR 2.09, 95% CI 1.52–2.87) remained statistically significant. Participants who primarily used news to acquire information about the pandemic and discussed the vaccination with friends or family were more likely to intend to get vaccinated.

In this model, female gender (AOR 0.65, 95% CI 0.47–0.90) was negatively associated with vaccination intention as was age, with older respondents being less likely to intend to get vaccinated

Table 1
Characteristics of the study population (N = 857).

	Total n (%)	Men n (%)	Women n (%)	p-value
Total	857 (100.0)	376 (43.8)	481 (56.1)	
Vaccination intention				0.015
No	110 (12.8)	46 (12.2)	64 (13.3)	
Probably no	135 (15.8)	59 (15.7)	76 (15.8)	
Undecided	171 (20.0)	64 (17.0)	107 (22.2)	
Yes, after others	171 (20.0)	66 (17.6)	105 (21.8)	
Probably yes	149 (17.4)	73 (19.4)	76 (15.8)	
Yes	121 (14.1)	68 (18.1)	53 (11.0)	
(Strong) vaccination intention [a]				0.063
No	416 (48.5)	169 (44.9)	247 (51.4)	
Yes	441 (51.5)	207 (55.1)	234 (48.6)	
Sources of information used				
Television				0.070
No	394 (46.0)	186 (49.5)	208 (43.2)	
Yes	463 (54.0)	190 (50.5)	273 (56.8)	
News				0.579
No	392 (45.7)	176 (46.8)	216 (44.9)	
Yes	465 (54.3)	200 (53.2)	265 (55.1)	
Social media				0.076
No	678 (79.1)	287 (76.3)	391 (81.3)	
Yes	179 (20.9)	89 (23.7)	90 (18.7)	
Official health hotlines				0.016
No	798 (93.1)	359 (95.5)	439 (91.3)	
Yes	59 (6.9)	17 (4.5)	42 (8.7)	
Official health websites				0.340
No	415 (48.4)	189 (50.3)	226 (47.0)	
Yes	442 (51.6)	187 (49.7)	255 (53.0)	
Other websites				<0.001
No	757 (88.3)	307 (81.6)	450 (93.6)	
Yes	100 (11.7)	69 (18.4)	31 (6.4)	
Conversation topics				
Risk of getting infected				0.666
No	547 (63.8)	243 (64.6)	304 (63.2)	
Yes	310 (36.2)	133 (35.4)	177 (36.8)	
Risk of infecting others				<0.001
No	481 (56.1)	244 (64.9)	237 (49.3)	
Yes	376 (43.9)	132 (35.1)	244 (50.7)	
COVID-19 vaccination				0.069
No	553 (64.5)	230 (61.2)	323 (67.2)	
Yes	304 (35.5)	146 (38.8)	158 (32.8)	
Age (mean, SD)	22.9 (5.8)	23.1 (5.9)	22.8 (5.7)	0.494
Born in Switzerland				0.797
No	154 (18.0)	69 (18.4)	85 (17.7)	
Yes	703 (82.0)	307 (81.6)	396 (82.3)	
Last degree obtained				0.922
Primary level	149 (17.4)	67 (17.8)	82 (17.0)	
Secondary level	429 (50.1)	189 (50.3)	240 (49.9)	
Tertiary level	279 (32.6)	120 (31.9)	159 (33.1)	
Coronavirus-related health literacy (mean, SD) [b]	16.8 (3.6)	17.2 (3.4)	16.5 (3.7)	0.005
Canton				0.235
Thurgau	173 (20.2)	73 (19.4)	100 (20.8)	
Ticino	491 (57.3)	208 (55.3)	283 (58.8)	
Zurich	193 (22.5)	95 (25.3)	98 (20.4)	
Risk perception [c]	2.9 (0.9)	2.7 (0.9)	3.1 (0.9)	<0.001
Trust [d]	3.5 (0.8)	3.5 (0.8)	3.6 (0.8)	0.241

Data are n (%) unless otherwise stated. n = number of observations.
[a] Strong vaccination intention: Yes = combined categories "Yes, after others"–"Yes"; No = combined categories "Undecided" and No".
[b] Coronavirus-related health literacy appraisal subscale: Scale from 5="lowest health literacy" to 25="highest health literacy".
[c] Risk perception: Scale from 1="not at all worried" to 5="extremely worried".
[d] Trust: Scale from 1="no trust at all" to 5="a great deal of trust".

(AOR 0.97, 95% CI 0.94–1.01). Vaccination intention was higher among participants with higher Coronavirus-related health literacy (AOR 1.04, 95% CI 1.00–1.09), higher risk perception (AOR 1.55, 95% CI 1.29–1.86), and higher trust (AOR 1.78, 95% CI 1.43–2.21).

3.3. Mediation analysis

Based on the significant associations found between information source "news" as well as conversation topic "COVID-19

Table 2

COVID-19 vaccination intention –logistic regression models.

	Model 1		Model 2		Model 3	
Variable	AOR	95% CI	AOR	95% CI	AOR	95% CI
Sources of information used						
Television (ref = no)	1.73***	1.28–2.34	1.53**	1.12–2.09	1.27	0.92–1.76
News (ref = no)	1.82***	1.35–2.45	1.70***	1.25–2.31	1.50*	1.09–2.07
Social media (ref = no)	1.46*	1.00–2.12	1.40†	0.96–2.05	1.40†	0.94–2.09
Official health hotlines (ref = no)	1.72†	0.96–3.07	1.51	0.83–2.76	1.31	0.70–2.46
Official health websites (ref = no)	1.51**	1.11–2.04	1.32†	0.97–1.81	1.14	0.82–1.59
Other websites (ref = no)	1.70*	1.07–2.70	1.56†	0.97–2.53	1.66†	1.00–2.77
Conversation topics						
Risk of getting infected (ref = no)			1.55**	1.13–2.12	1.32†	0.95–1.83
Risk of infecting others (ref = no)			1.48*	1.09–2.01	1.12	0.81–1.60
COVID-19 vaccination (ref = no)			2.13***	1.57–2.90	2.09***	1.52–2.87
Age	0.95**	0.92–0.98	0.96**	0.93–0.99	0.97+	0.94–1.01
Female gender (ref = male)	0.77†	0.58 – 1.03	0.75†	0.55 – 1.01	0.65**	0.47 – 0.90
Not born in CH (ref = born in CH)	0.71†	0.48–1.03	0.73	0.49–1.08	0.90	0.60–1.36
Last degree obtained (ref = primary level)						
Secondary level	0.87	0.57–1.33	0.76	0.49–1.18	0.82	0.52–1.29
Tertiary level	1.56	0.92–2.65	1.25	0.73–2.17	1.19	0.67–2.10
Coronavirus-related health literacy	1.05*	1.01–1.09	1.05*	1.01–1.097	1.04†	1.00–1.09
Canton (ref = Thurgau)						
Ticino	1.38†	0.95 – 2.00	1.48*	1.01–2.17	1.34	0.89–1.99
Zurich	1.16	0.76–1.79	1.17	0.75–1.83	1.16	0.73–1.85
Risk perception [b]					1.55***	1.29–1.86
Trust [c]					1.78***	1.43–2.21
Observations	859		858		857	
Pseudo R	0.058		0.094		0.149	

ref = reference category; AOR = Adjusted Odds Ratio; CI = confidence interval; CH = Switzerland.

[a] Coronavirus-related health literacy appraisal subscale: Scale from 5 = lowest health literacy to 25 = highest literacy.

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

[b] Risk perception: Scale from 1 = not at all worried to 5 = extremely worried.

[c] Trust: Scale from 1 = no trust at all to 5 = a great deal of trust.

vaccination" and COVID-19 vaccination intention a mediation analysis was performed.

3.3.1. Information source "news" as mediator

The direct, indirect, and total effects of determinants and mediator on vaccination intention are reported in the supplement 2, Table S2. There was a positive direct relationship between "news" and vaccination intention (b = 0.321, p = 0.036). Coronavirus-related health literacy (b = 0.044, p = 0.042), trust (b = 0.610, p < 0.001), and risk perception (b = 0.517, p < 0.001) were confirmed as significant direct predictors of vaccination intention. Age (b = −0.035, p = 0.035) and female gender (b = −0.504, p = 0.001) showed a significant direct negative relationship with vaccination intention.

The individual determinants education, born in Switzerland, and trust were significantly associated with the information source "news". Their effect on vaccination intention was mediated by "news": Secondary educational level (b = 0.232, p = 0.076) and tertiary educational level (b = 0.366, p = 0.059) were fully mediated via the information source news, while trust was partially mediated (b = 0.105, p = 0.076). Fig. 1 shows the mediation model for the information source news (for effect estimates see supplement 2, Table S3).

3.3.2. Conversation topic "COVID-19 vaccination" as mediator

The direct, indirect, and total effects of determinants and mediator on vaccination intention are reported in supplement 2, Table S4. There was a strong positive direct relationship between "conversation" and vaccination intention (b = 0.782, p < 0.001). Furthermore, trust (b = 0.629, p < 0.001), and risk perception (b = 0.492, p < 0.001) yielded a significant direct association with vaccination intention.

The relationship between individual determinants and vaccination intention were partially and fully mediated by "conversation". The effects of female gender (b = -0.267, p = 0.039) and risk perception (b = 0.163, p = 0.028) were partially mediated by "conversation". The effects of age (b = −0.036, p = 0.016), secondary educational level (b = 0.541, p = 0.010) and tertiary educational level (b = 0.726, p = 0.006) were fully mediated via "conversation". Fig. 2 shows the significant pathways of the mediation model for the vaccination conversation topic(see table with effect estimates in supplement 2, Table S5).

4. Discussion

Among Swiss people aged 15–34 in Switzerland surveyed in this study, half were willing to be vaccinated against COVID-19 before the vaccine became available. News as information source, having conversations about the vaccine development and availability, male gender, trust in cantonal and federal government and scientists, and risk perception about COVID-19 were significantly positively associated with COVID-19 vaccination intention. Furthermore, conversation about vaccination was a significant mediator.

The vaccination intention in our sample is similar the vaccination willingness found in a sample of young adults aged 22 surveyed in September 2020 in Zurich [40]. A cross-sectional survey in a similar time period as our study (October to December 2020) reports a vaccination intention in young people of 84.3% in Canada and 59.7% in France [41]. Our data were collected in winter 2020/2021, before COVID-19 vaccines were available to young people in Switzerland. Already prior to its availability, vaccinations were heavily discussed in the Swiss and global societies. Our data indicate that half of the young people had made up their mind
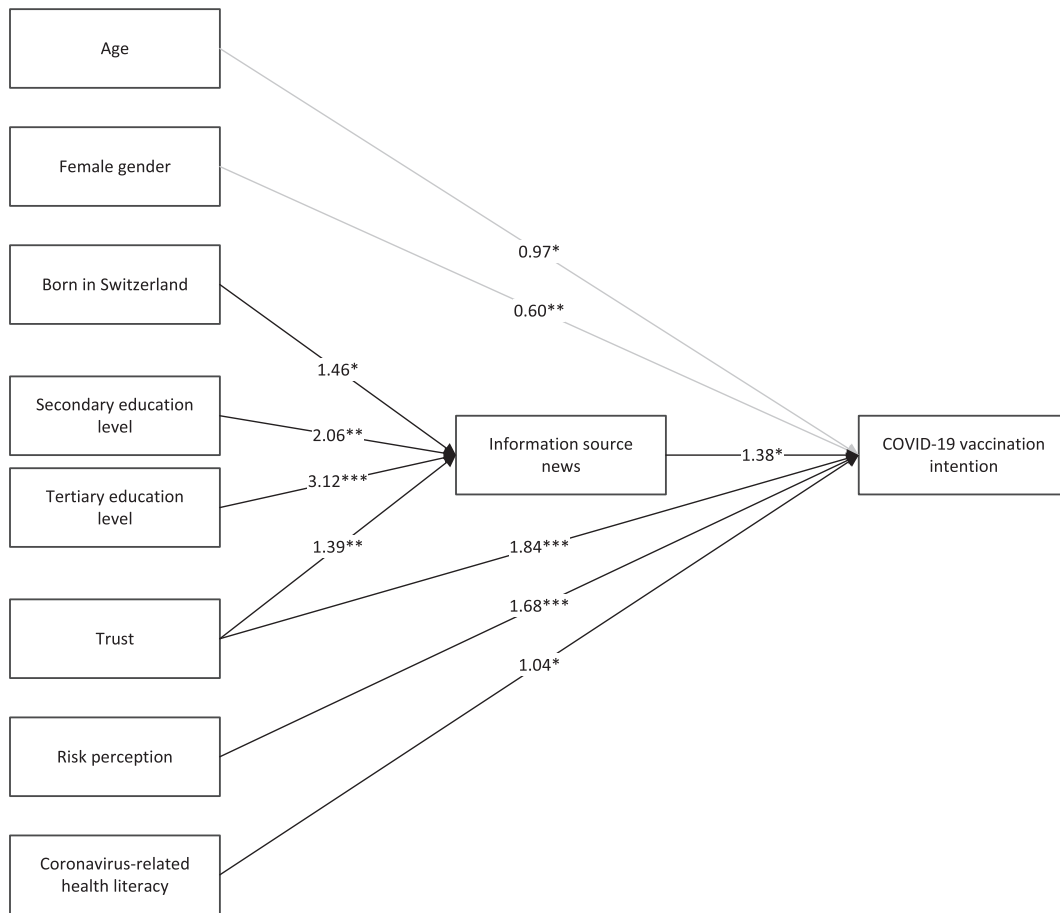
Fig. 1. Mediation model of information source news and COVID-19 vaccination intention. The parameter estimates on the arrows represent the odds ratio (OR). Single headed arrows show direction of effect. Black arrows shows a positive association and grey arrows a negative association; * p < 0.05, ** p < 0.01, *** p < 0.001.
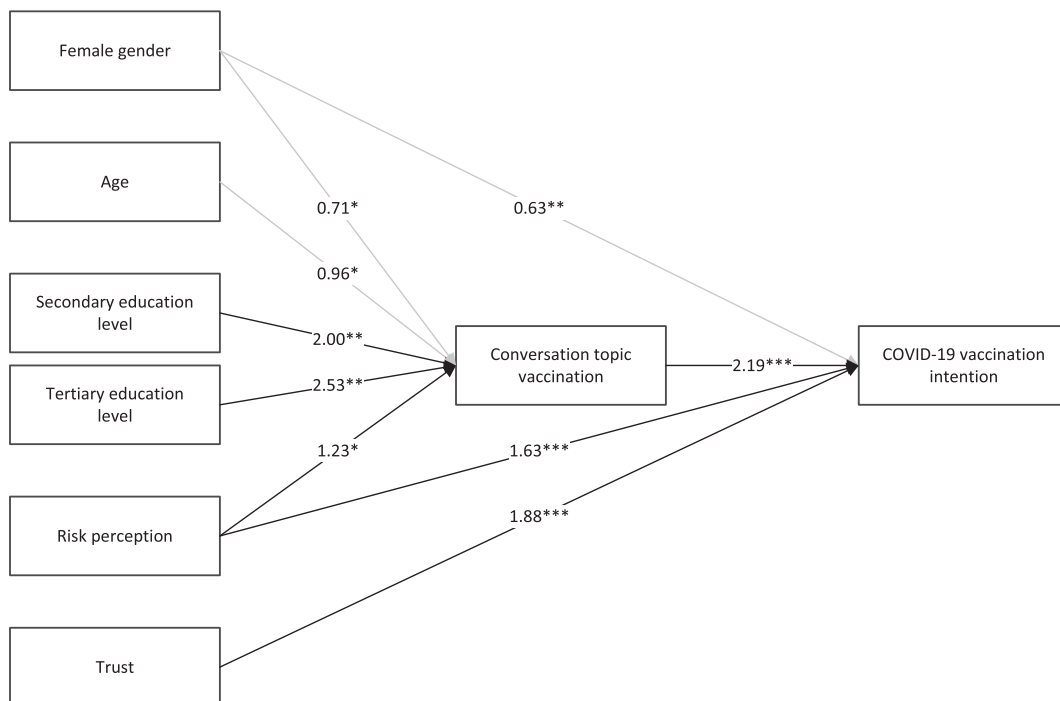

Fig. 2. Mediation model of vaccination conversation topic and COVID-19 vaccination intention. The parameter estimates on the arrows represent the odds ratio (OR). Single headed arrows show direction of effect. Black arrows show a positive association and grey arrows a negative association; * p < 0.05, ** p < 0.01, *** p < 0.001.

early on and that the conversations on vaccinations played a role in the decision taking process. This points to the need to foster (positive) discussions as early as possible.

With regard to COVID-19 information sources, *"news"* was positively associated with vaccination intention. Our item assessing young people's news seeking behavior covered news in print newspaper but also online news and news portals. Respondents using this source had 1.5 times higher odds to get vaccinated. In addition, our mediation analyses indicated a partial mediation of "trust in government and science" and a fully mediating effect of "education level" on vaccination intention via the information source "news", both borderline significant. Similar to our findings, Elliot et al. [42] observed that vaccine hesitant US students were less likely to rely on newspapers for health information compared to not hesitant respondents. More evidence is available in adults. Lee and Lou [24] report that offline media such as TV, radio, and news were associated with higher perceived benefits of a COVID-19 vaccine and higher trust in government, which led to lower vaccine hesitancy in South Korean adults [24]. In US adults, Piltch-Loeb et al. [43] and Fisher et al. [16] found that traditional channels of information including national and local news increased the likelihood of vaccine acceptance. Respondents from vaccine priority groups who obtained information from a national newspaper were 80% more acceptant compared to those who did not [43]. A national survey in South Korea demonstrated that those who spent more time reading print newspapers were 32% more likely to be vaccinated [44]. The influence of traditional media sources on hesitancy has also been shown for influenza vaccination. Hwang [45] found that adults in the US who assigned more value to medical professionals, medical journals, and newspaper articles were more likely to receive the influenza vaccine [45].

Our findings showed that *talking with others about the vaccination development and availability* was positively associated with COVID-19 vaccination intention. Respondents who talked about this topic with friends and family were two times more likely to get vaccinated. The mediation analysis reveals that conversations about vaccination partially mediated the effect of "gender" and the effect of "risk perception" on vaccination intention. Males and persons with a higher risk perception were more likely to discuss COVID-19 vaccination and intended to get vaccinated when the vaccines were available to them. Conversation about COVID-19 vaccination fully mediated the effect of "age" and the effect of "education level" on vaccination intention with higher educated persons and older persons being more likely to talk about vaccination. Our results are in line with findings of Xu et al. [27], which demonstrated that healthcare workers in China with a "vaccination consulting network", i.e., friends with whom they were willing to discuss COVID-19 vaccination, were less hesitant. It could be that friends or family members promote vaccination through their own vaccination experiences, recommendations, or by scheduling vaccination appointments [28]. A scoping review by Konstantinou et al. [31] highlights that people have more positive attitudes towards vaccination and are more likely to vaccinate if they frequently talk about vaccination with others who have similar attitudes. In contrast, negative attitudes in social networks lead to lower vaccination rates. In general, clustering of vaccination attitudes can be observed, i.e., vaccine acceptors are more likely to know and associate with other acceptors, while non-vaccinators are more likely to know and associate with other non-vaccinators [28,46]. On the one hand, talking about vaccination may be important to establish an opinion towards vaccination and on the other hand talking with friends and family could help to clarify the attitudes of one's own network and adjust intentions accordingly. This supports research showing that social norms can act as facilitators when tailored to the target group and delivered

by a member of the target group [47], such as personal testimonials of vaccination experiences [48].

Trust in government and science was positively associated with COVID-19 vaccination intention. Respondents indicating higher trust had 1.78 higher odds of getting vaccinated. The important role of trust has been shown in several studies [8,9,32]. In Switzerland, trust in the government is generally high [49], although a decline was observed in the course of the pandemic [50]. For example, Zysset et al. [51] found that 87% of Swiss students voiced trust in the federal council at the beginning of the pandemic in April 2020. However, this number had almost halved by January 2021 [32].

Risk perception was positively associated with COVID-19 vaccination intention. Similar results were found by Schwarzinger et al. [10] and Ruiz and Bell [11] who found that vaccine refusal was associated with lower perceived severity of COVID-19. Risk perception is different in young people than older populations because, at the time of this study, they were less likely to be hospitalized or to die from COVID-19 [52]. The rather strong effect of risk perception in our study could be due to the concern of infecting others, as our respondents most likely still live with their parents or even grandparents or visit them frequently.

Regarding *sociodemographic characteristics*, women were less likely to get vaccinated against COVID-19. Also Dratva et al. [32] found that male students in Switzerland had 30% higher odds to get vaccinated. It is well researched that gender is an important factor of vaccine hesitancy. In general, women are more likely to be afraid of the side effects and fear that vaccines may harm them or are in-effective [53]. Regarding COVID-19 vaccines, several studies have shown that women tend to be more hesitant than men [8,10,11,32,54]. However, a rapid review indicated a large inconsistency of results [19].

Several limitations have to be taken account: we cannot say whether in the conversations about vaccination among friends and family positive or negative arguments were shared. The overall positive association and prior knowledge implies conversations were either more frequently positive or the positive conversation effect was relatively stronger than the negative conversation effect. While our findings are representative of three cantons, they are not for the whole of Switzerland. The sample included cantons of German- and Italian-speaking Switzerland, but not French-speaking cantons. Early in the pandemic, the Italian-speaking and French-speaking regions were more affected and had higher infection rates compared to the German-speaking regions. We adjusted for the region our participants lived in and this covariate was not significant in the final model, but we still cannot generalize the results to the French-speaking region.

5. Implications and conclusions

This study provides evidence about COVID-19 vaccination intentions of young people aged 15–34 years in Switzerland at a timepoint when the vaccines where not yet available to the age-group. We found that using the information source "news" and conversation about COVID-19 vaccination with family and friends is an important predictor for vaccination intention and individual determinants are mediated through these factors. The role of "news" indicates that a high standard of journalistic content and ensuring access to such high quality news is important for a high vaccination intention. The mediation of educational level through news suggests that lower educational levels access these "news" less frequently or they do not have the same effect. Our data support previous results of higher vaccination hesitancy in females, which suggests a targeted social norm intervention for young

women and less educated people that could comprise elements like motivation to talk about vaccination and to include print and digital news when seeking information. Our data also indicate that conversation not only among friends and family but also in form of campaigns or public conversations should start even before vaccines become available. The coverage increased from 51% when the data were collected to only 71–73% in the age group of 20–39-year-olds in July 2021. Clearly, more needs to be done to increase acceptance after vaccines are made available. Finally, our results underline the role of trust in public authorities and risk perception in vaccination intention and add to the evidence in young people. Creating and keeping this trust high is of utmost relevance.

CRediT authorship contribution statement

Aylin Wagner: Formal analysis, Writing – original draft, Writing – review & editing. **Sibylle Juvalta:** Data curation, Validation, Writing – original draft, Writing – review & editing. **Camilla Speranza:** Data curation, Validation, Writing – review & editing. **L. Suzanne Suggs:** Funding acquisition, Conceptualization, Methodology, Writing – review & editing. **Julia Drava:** Funding acquisition, Conceptualization, Methodology, Writing – review & editing.

Data availability

The data and the code used for this publication are available at: https://doi.org/10.5281/zenodo.8134399

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.

Acknowledgments

We would like to thank the respondents that participated in the study for their engagement and time.

Financial disclosure

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2023.07.004.

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