

Confident and altruistic – parents' motives to vaccinate their children against COVID-19: a cross-sectional online survey in a Swiss vaccination centre

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Summary

AIMS OF THE STUDY: In Switzerland, COVID-19 vaccines have been approved for children aged 5–11 years only recently, whereas vaccination of adolescents aged 12 years and older was approved in early summer 2021. Although the disease burden in children and adolescents has been reasonably mild, they can transmit COVID-19 to others, thus vaccinating this age group may help to curb the COVID-19 pandemic. The main objective was to investigate the association between five psychological antecedents of vaccination hesitancy in COVID-19 immunised parents and their intention to have their child vaccinated against COVID-19. Further, we examined if parental vaccination history and conviction of the benefits of Swiss paediatric vaccination recommendations are associated with child vaccination intention, and where parents would like the vaccination performed.

METHODS: A cross-sectional anonymous online survey in the COVID-19 vaccination centre Winterthur was conducted between 16 May and 30 September 2021. Individuals receiving COVID-19 vaccines in the vaccination centre were invited to participate. All individuals who participated in the survey after their first dose with children under 16 years were included in the analysis (n = 1318). Using multivariable logistic regression, the association between our main predictor variables, psychological antecedents (confidence, constraints, complacency, calculation, collective responsibility) measured by the validated 5C scale, and parents' intention to have their child vaccinated against COVID-19 was analysed, adjusted for parental vaccination history, conviction of benefits of vaccination recommendations for children and adults, children's age group, sociodemographic factors, and time-point of vaccine authorisation for 12–16-year-olds.

RESULTS: 58.7% of the parents intended to vaccinate their child against COVID-19. Their preferred vaccination location for their child was the paediatrician or family doc-

tor. Three psychological antecedents were associated with vaccination intention: confidence (adjusted odds ratio [AOR] 1.33, 95% confidence interval [CI] 1.00–1.76; borderline significant), calculation (AOR 0.68, 95% CI 0.58–0.81), and collective responsibility (AOR 1.93, 95% CI 1.47–2.52). Influenza vaccination (AOR 1.53, 95% CI 1.15–2.03) and conviction of the benefits of the Swiss vaccination recommendations for children and adolescents were independently associated with parental vaccination intention.

CONCLUSIONS: Campaigns on COVID-19 vaccination for children may increase the intention of parents to have a child vaccinated when they address collective responsibility and calculation (weighing risks and benefits), independent of the conviction of the benefits of the vaccination recommendations, which was also a significant factor. The findings further show that parents of younger children favour their paediatrician or family doctor over vaccination centres as the vaccination setting for their child, an important finding for paediatric COVID-19 vaccination strategies.

Introduction

Herd immunity for COVID-19 is critical to get the pandemic under control [1]. Like adults, children and adolescents infected with COVID-19 can transmit the virus to others [2, 3]. There is an ongoing public and scientific debate on the need for and relevance of vaccinating children, while vaccination of adolescents is strongly recommended and generally accepted. Although the disease burden in children and adolescents has been reasonably mild [4], COVID-19 vaccines can prevent them from becoming seriously ill (e.g., multisystem inflammatory syndrome in children) [5]. Evidence also indicates that long COVID occurs in children and adolescents [6–8] and that vaccination should protect against long COVID in this age group [9].

In Switzerland, COVID-19 vaccines have been authorised for young people aged 12 years and older since 4

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June 2021 [10, 11], and only recently in December 2021 were vaccines approved for 5–11-year-olds [12]. The COVID-19 vaccination is recommended for children and adolescents to protect them from frequent mild and very rare severe cases of COVID-19. This applies especially to children and adolescents with a chronic illness and who are in close contact with people at high risk, such as people with a weakened immune system [10]. In addition, increasing the general vaccination coverage will reduce infection risk and cases overall. Protecting others, avoidance of negative effects of measures (e.g., isolation, quarantine), and regaining mobility and access to free-time activities are additional motives for adolescents and young people, especially [13, 14].

Nevertheless, vaccine hesitancy forms a critical barrier to the uptake of the COVID-19 vaccine. The reasons why people do not get vaccinated are often complex. Regarding COVID-19 vaccines, the novelty of the vaccines and the use of new technologies such as messenger RNA are major contributors to public uncertainty and scepticism. In general, psychological factors and traits are decisive for individuals' opinion on vaccinations. For example, the 5C model, which comprises several psychological theories for predicting preventive behaviour and is based on established theoretical models of vaccine hesitancy and acceptance, includes five psychological antecedents of vaccination: first, confidence, defined as trust in safety and effectiveness of vaccines and the system that delivers them; second, complacency, which reflects the perceived risks of vaccine-preventable diseases; third, constraints, which refers to perceived structural or psychological barriers to vaccination; fourth, calculation, which relates to weighing the risks and benefits of vaccination and individuals' engagement in extensive information seeking about vaccination; and finally, collective responsibility, which reflects the willingness to protect others by one's own behaviour [15].

Concerning routine vaccinations for children, parental attitudes and beliefs are strongly associated with vaccination intention [1, 16]. In general, positive attitudes towards vaccination are associated with the decision to vaccinate [17]. This applies also to COVID-19 vaccines. Studies show that the most important psychological drivers of parental COVID-19 vaccination intention are beliefs that vaccination against COVID-19 is necessary [18–20] (complacency), confidence in the safety of the vaccine [18–20], and trust in public health authorities and health sciences [19]. Furthermore, several studies found that parents' COVID-19 vaccination or likelihood of vaccination was the most important factor independently associated with the likelihood of children getting the vaccine [18, 20–22]. Other influencing factors are parental vaccination history [2, 23], sex [2, 21, 24] and education level [23] as well as characteristics of the child such as age [2, 22], presence of a chronic illness [2], and status of the childhood vaccination schedule [22]. Particularly with regard to gender, findings are consistent, highlighting a major gap between mothers and fathers, with mothers being more vaccine hesitant than fathers [2, 21, 24].

In Switzerland, little is known about parents' intentions to have their child vaccinated against COVID-19 and associated factors. Therefore, this study investigated the association between the psychological antecedents of standard

vaccinations, measured with the 5C scale [15], in parents who received the COVID-19 vaccination themselves and their intention to have their child vaccinated against COVID-19, once available. Further, we wished to understand how previous parental vaccination history and the conviction of the benefits of the Swiss vaccination recommendations for children and adolescents are associated with the child vaccination intention, and where and by whom parents would like to have the COVID-19 vaccination to be performed.

Material and methods

Study design

We conducted a cross-sectional study at the COVID-19 vaccination centre Winterthur, Switzerland.

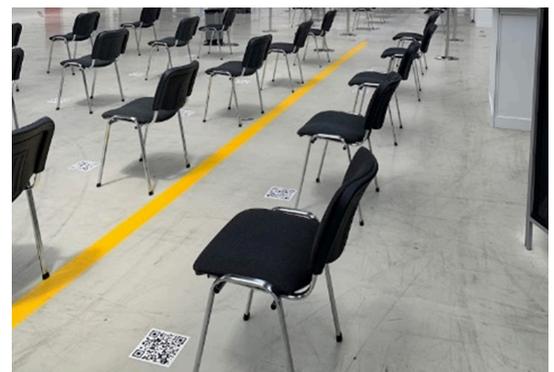
The COVID-19 vaccination centre Winterthur provides COVID-19 vaccination services for the residents of the city of Winterthur and the surrounding area with the capability to administer over 5000 vaccinations per day. The study was in accordance with the Declaration of Helsinki and was submitted to the Cantonal Ethics Committee of the Canton of Zurich, Switzerland. The study does not fall under the Human Research Act and an exemption of an ethical review was received (BASEC-Nr. Req-2021-00347). This manuscript was prepared in compliance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist [25].

Study population and data

The study population corresponded to a self-selected sample of individuals vaccinated against COVID-19 at the vaccination centre Winterthur between 13 April and 30 September 2021. All individuals at the vaccination centre had access to a flyer with information about the study and a web link / QR code to access the survey. Further, a QR code on the floor in front of the seats in the waiting area led to the online landing page with main study information and online consent as well as the online questionnaire (fig. 1).

For this analysis, we included survey participants having received the first dose of the vaccine between 16 May and 30 September 2021, and who had children under 16 years. We did not foresee the inclusion of respondents after the second dose of vaccine; firstly, we assumed the intention

Figure 1: QR code at the vaccination centre Winterthur (Source: Impfzentrum Winterthur, 2021).



would not change in such a short interval (4 weeks), and secondly, the anonymity of the data did not allow a linkage of individual data sets. Respondents answering the questionnaire before 16 May 2021 were excluded because the question regarding children's age was added to the questionnaire on that date.

Online questionnaire

The questionnaire included sociodemographic factors, vaccination history (parents and children), psychological antecedents of vaccination (5C scale: confidence, constraints, complacency, calculation and collective responsibility), motifs for COVID-19 vaccination, service experience in the vaccination centre (infrastructure of the vaccination centre, process of vaccination, satisfaction with staff), side effects of the COVID-19 vaccination (first and second dose), preferred vaccination location (parents and children), parental COVID-19 vaccination intention, self-rated health status, previous COVID-19 infection and stress factors caused by the pandemic (containment measures, contracting COVID-19, COVID-19 infection, COVID-19 testing). Participants had to actively provide their consent online before accessing the online questionnaire. The anonymity of participants was always guaranteed.

Measures

Outcome variables

The primary outcome variable was parents' intention to vaccinate their child against COVID-19, which was measured with a single item, used in the HES-C study [26] and the Swiss National Corona Immunitas Study [15] to measure vaccination intention in students and the general population, respectively. Respondents were asked the following: "Once the COVID-19 vaccine is approved for adolescents/children, will you get your child/children vaccinated?", using a 6-point Likert scale (1 = no, 2 = probably no, 3 = undecided, 4 = yes, after others, 5 = probably yes, 6 = yes). For the analysis, the responses were recoded into binary categories 0 = low vaccination intention ("no", "probably no", and "undecided") and 1 = strong vaccination intention ("yes", "probably yes", "yes, after others"). A secondary outcome was the location in which parents preferred to have their child vaccinated, should vaccination against COVID-19 become necessary in the future.

Predictor variables

Parental psychological antecedents of standard vaccination were measured using the validated 5C scale [15]. The 5C scale is a self-assessment questionnaire that measures five different antecedents of vaccine hesitancy: (1) confidence (trust in the effectiveness and safety of vaccines and in the providers/system), (2) complacency (perceived disease risk), (3) constraints (perceived structural or psychological barriers to vaccination), (4) calculation (risk-benefit calculation), and (5) collective responsibility (willingness to benefit others by receiving vaccination). The questionnaire comprised 15 items to be rated on a 5-point Likert scale (from "strongly disagree" to "strongly agree"). Scores on each sub-scale represent the mean scores of the scale's items and range from 1 to 5, with higher values rep-

resenting more agreement with the antecedent, e.g., more confidence or more perceived constraints.

Previous parental vaccination history was assessed for influenza vaccination (0 = no, 1 = yes) and for travel vaccinations as a medical precaution (0 = no, 1 = yes). Participants were also asked to indicate on a 10-point scale the extent to which they were convinced of the benefits of the Swiss vaccination recommendations for children and adolescents.

Covariates

Parental sociodemographic covariates included age, sex (0 = women, 1 = men) and highest education level (0 = low: no educational qualification, compulsory schooling, apprenticeship; 1 = middle: grammar school, professional maturity, higher technical and vocational training; 3 = high: university, university of applied sciences, ETH). Data on children were restricted to the age range of the oldest child under 16 years (0 = 0–5 years, 1 = 6–11 years, 2 = 12–15 years). Since COVID-19 vaccines were approved for adolescents aged 12 years and older on 4 June 2021 [11], we controlled for time of authorisation (0 = before vaccine authorisation, 1 = after vaccine authorisation).

Statistical analyses

The analytic sample consisted of complete cases only. We used the Stata *mdesc* and *mypatterns* commands to assess incomplete cases. We detected no systematic patterns in the missing data. Missing values of individual variables were in the range between 0% and 0.82%. Descriptive statistics were run concerning the sample characteristics, and univariate t-tests and chi-square tests were used to assess univariate group differences by gender and vaccination intention (supplemental table S1 in the appendix).

Multivariable logistic regression models were applied to estimate the association between psychological antecedents (5C scale: confidence, complacency, constraints, calculation, collective responsibility) and parental COVID-19 vaccination intention regarding their child. In a first model, we included the 5C vaccination antecedents. Further models were adjusted for vaccination history (travel vaccination and influenza vaccination), the conviction of the benefits of the Swiss vaccination recommendations for children and adolescents (model 2), and age, sex, education level, children age group, and time of vaccine authorisation (model 3, full model). We report adjusted odds ratios (AORs) with corresponding 95% confidence intervals (95% CIs) for the single components of the 5C scale and the model covariates. Statistical significance was established at $p < 0.05$. We used Stata version 15.1 (Stata Corp, College Station, TX, USA) for statistical analyses.

Results

Study sample

In total, 6500 people completed the survey after the first dose of COVID-19 vaccination, of whom 1604 (24.7%) had a child under 16 years of age. A total of 257 parents were excluded because they answered the questionnaire before 16 May 2021 and therefore had missing values for the variable children's age. This left 1347 (20.7%) parents

who fulfilled the inclusion criteria. Information on parental COVID-19 vaccination intention, our primary outcome, was provided by 1344 respondents (99.8%) and complete data for all variables used in our model were available for 1318 respondents (97.9%).

The analytic sample of 1318 parents consisted of 590 mothers (44.8%) and 728 fathers (55.2%) (table 1). The mean age of the parents was 41 years (standard deviation [SD] 6.5). The mean ages for mothers and fathers differed significantly ($p = 0.004$) and were 41 years (SD 6.4) and 42 years (SD 6.5), respectively. Regarding the psychological antecedents of vaccination (5C scale), compared with fathers, mothers expressed significantly higher levels of collective responsibility ($p < 0.001$) and significantly lower complacency ($p = 0.015$). Overall, 36.2% of the parents had been vaccinated in the past against seasonal influenza and 60.5% reported a previous travel vaccination. The conviction of the benefits of the Swiss vaccination recommendations for children and adolescents was generally high among the parents with a mean value of 7.9 on a 10-point scale (SD 2.2). Mothers' conviction was slightly higher than fathers' (8.0 vs. 7.8, $p = 0.065$). In 26.6% of the participants, the oldest child under 16 years was between 12 and 15 years old, in 35.3% between 6 and 11 years old, and in 38.1% between 0 and 5 years old. Three-fifths of the parents reported a high education level. There was a significant difference regarding the education level ($p < 0.001$) between the genders.

Parental COVID-19 vaccination intention

Overall, 58.7% of the parents expressed an intention to have their child vaccinated against COVID-19 ("yes", "probably yes", "yes after others"). Vaccination intention was significantly lower in mothers than fathers ($p = 0.011$) (table 1). 17.4% of the parents indicated that they would have their child vaccinated against COVID-19 ("yes"), and 4.1% responded they would not have their child vaccinated ("no"); 78.4% were not absolutely sure ("probably yes" 32.2%, "probably no" 16.7%), undecided (20.5%), or wished to wait for others to vaccinate their children first (9.0%).

Parental vaccination intention differed significantly by child age group (fig. 2). The vaccination intention of parents with older children was significantly higher than those of parents with younger children ("strong vaccination intention" 12–15 years = 72.0%, 6–11 years = 55.9%; 0–5 years = 52.1%; $p < 0.001$).

Preferred vaccination location

Among parents willing to have their child vaccinated against COVID-19 ("yes", "probably yes", "yes after others"), 70.3% would, in future, prefer to have their child vaccinated at their paediatrician or family doctor practice, 25.6% at a COVID-19 vaccination centre and 4.2% at a pharmacy (fig. 3). No significant difference was found by parental gender. Parents of children aged 12–15 years showed a higher preference to vaccinate their child in a vaccination centre than parents of children aged 0–5 and 6–11 years ($p < 0.001$).

Predictors associated with parental COVID-19 vaccination intention

The multivariable logistic regression (table 2) yielded significant associations with the 5C vaccination antecedents both in the unadjusted and adjusted models. In the unadjusted model (model 1), four of the 5C dimensions were significantly associated with vaccination intention. Adjusting for previous influenza and travel vaccination (model 2) led to an attenuation of the effect and the significance level of the 5C domains, but remained statistically significant. In the fully adjusted model (model 3), confidence turned borderline significant. Parents who expressed more confidence in vaccinations were more likely to be willing to vaccinate their child against COVID-19 (OR 1.33, 95% CI 1.00–1.76). Collective responsibility and calculation showed no change in effect size or significance level in the fully adjusted model. Collective responsibility, i.e., willingness to protect others, remained significantly associated with vaccination intention (OR 1.93, 95% CI 1.47–2.52), whereas calculation, i.e., risk-benefit calculation, was associated with lower vaccination intention (OR 0.68, 95% CI 0.58–0.81).

Furthermore, in the full model (model 3) parental COVID-19 vaccination intention was positively associated with parents' previous influenza vaccination (OR 1.53, 95% CI 1.15–2.03), but not with travel vaccination, and with a higher conviction of the benefits of the Swiss vaccination recommendations for children and adolescents (OR 1.40, 95% CI 1.29–1.51).

Covariates associated with vaccination intention

Vaccination intention was higher among parents whose oldest child was between 12 and 15 years old (OR 2.93, 95% CI 1.84–4.67), fathers (OR 1.66, 95% CI 1.26–2.18), older parents (OR 1.04, 95% CI 1.01–1.07). Educational level was not statistically significant. Among parents who participated after the authorisation of the vaccine for children aged 12 years and older, vaccination intention was lower than in parents responding before this date (OR 0.63, 95% CI 0.48–0.83).

Discussion

In a sample of Swiss German-speaking parents who got vaccinated themselves against COVID-19, we found a relatively high level of parental intention to vaccinate their child against COVID-19. Overall, 58.7% of the parents reported the intention to have their child vaccinated against COVID-19 once the vaccine was available. Calculation and collective responsibility proved to be the strongest psychological antecedents associated with the vaccination intention.

To our knowledge, this is the first Swiss study on child vaccination intention in parents not opposed to COVID-19 vaccination as such. Most studies on parental vaccination intention in the general public showed a similar result to ours. Humble et al. [18] found that 63.1% of Canadian parents intended to vaccinate their child against COVID-19 and Altenbuchner et al. [24] reported 52.3% for German parents. Skjefte et al. [19] observed the highest rate of vaccination intention (69.2%) in an international study for young mothers from 16 different countries. Our finding

might overestimate the vaccination intention of parents in Switzerland, as the parental COVID-19 vaccination intention could be higher in vaccinated parents than in the non-vaccinated population. In fact, previous studies showed that the vaccination status of parents is a main predictor of the intention to vaccinate their child [18, 20–22]. Current vaccination rates indicate a lower vaccination rate of 44% in 12–15-year-olds and 3% in 5–11-year-olds than these early intention data suggested [27]. Our study found that 72% of parents of 12–15-year-olds and 55.9% of parents of 6–11-year-olds would have their child vaccinated, but these data stem from a population of vaccinated parents. In addition, the late authorisation of the vaccine for children aged 5–11 years (December 2021) and high COVID-19

cases in children may contribute to the current low vaccination rate.

Regarding the psychological antecedents (5C scale), we found a positive association of the dimensions confidence and collective responsibility, and a negative association with the dimension calculation. However, no significant association was found for complacency and constraints.

The dimension confidence was asked in the context of general vaccinations recommended for adults, and measures trust in the effectiveness and safety of vaccinations as well as in the system that delivers them. It seems intuitive that such trust would increase vaccination willingness, and our data imply that confidence in vaccinations for oneself is associated with trust in child vaccinations. After the variable

Table 1:
Characteristics of the study population (n = 1318).

	Total n (%)	Women n (%)	Men n (%)	p-value
Total	1318 (100.0)	590 (44.8)	728 (55.2)	
Vaccination intention				0.016
– No	54 (4.1)	20 (3.4)	34 (4.7)	
– Probably no	220 (16.7)	103 (17.5)	117 (16.0)	
– Undecided	270 (20.5)	143 (24.2)	127 (17.5)	
– Yes, after others	119 (9.0)	57 (9.7)	62 (8.5)	
– Probably yes	426 (32.2)	171 (29.0)	255 (35.0)	
– Yes	229 (17.4)	196 (16.3)	133 (18.3)	
(Strong) vaccination intention ^a				0.011
– No	544 (41.3)	266 (45.1)	278 (38.2)	
– Yes	774 (58.7)	324 (55.0)	450 (61.8)	
5C vaccination antecedents (mean) ^b				
– Confidence	4.43	4.42	4.45	0.353
– Complacency	1.91	1.86	1.95	0.015
– Constraints	1.44	1.42	1.46	0.213
– Calculation	3.87	3.88	3.86	0.663
– Collective responsibility	4.52	4.59	4.47	<0.001
Influenza vaccination				0.002
– No	841 (63.8)	350 (59.3)	491 (67.5)	
– Yes	477 (36.2)	240 (41.7)	237 (32.6)	
Travel vaccination				0.553
– No	521 (39.5)	239 (40.5)	282 (38.7)	
– Yes	797 (60.5)	351 (59.5)	446 (61.3)	
Conviction on the benefits of the vaccination recommendation, mean (SD) ^c	7.9 (2.2)	8.0 (2.1)	7.8 (2.3)	0.065
Age (years), mean (SD)	41 (6.5)	41 (6.4)	42 (6.5)	0.004
Education level				<0.001
– Low	204 (15.5)	122 (20.7)	82 (11.3)	
– Middle	316 (24.0)	138 (23.4)	178 (24.5)	
– High	798 (60.6)	330 (55.9)	448 (64.3)	
Age of oldest child under 16 years				0.513
– 0–5 years	502 (38.1)	215 (36.4)	287 (39.4)	
– 6–11 years	465 (35.3)	216 (36.6)	249 (34.2)	
– 12–15 years	351 (26.6)	159 (27.0)	192 (26.4)	
Time of vaccine authorisation ^d				0.841
– Before authorisation	521 (39.5)	235 (39.8)	286 (39.3)	
– After authorisation	797 (60.5)	355 (60.2)	442 (60.7)	
Preferred vaccination location (only participants willing to vaccinate their child)				0.222
– Vaccination centre	197 (25.6)	74 (23.0)	123 (27.4)	
– Paediatrician or family doctor	542 (70.3)	237 (73.6)	305 (67.9)	
– Pharmacy	32 (4.2)	11 (3.4)	21 (4.7)	

Data are n (%) unless otherwise stated. n: number of observations

^a Strong vaccination intention: Yes = combined categories "Yes, after others", "Probably yes", "Yes"; No = combined categories "Undecided", "Probably no", "No"

^b 5C vaccination antecedents: scale from 1 = strongly disagree to 5 = strongly agree

^c Conviction of the benefits of the Swiss vaccination recommendation for children and adolescents: scale from 1 = not convinced at all to 10 = very convinced

^d COVID-19 vaccines for children aged ≥ 12 years were approved in Switzerland on 4 June 2021

“conviction of the benefits of the vaccination recommendations for children and adolescents”, the dimension confidence was attenuated in strength and significance level. The parental conviction of the benefits of the vaccination recommendations was associated with 40% higher odds of vaccinating one’s child. This indicates that the trust in the vaccination recommendations is of higher relevance than the psychological antecedent confidence.

It seems that the aspect of collective responsibility is crucial regarding the intention not only to vaccinate oneself but also to vaccinate children [28–32]. This interpretation is affirmed by the association found between parents’ past influenza vaccination and vaccination intention, whereas

travel vaccination was not positively associated with child vaccination intention. Indeed, travel vaccinations are mainly for self-protection, while the influenza vaccination has both aspects, personal and collective gain.

With respect to the dimension calculation, high scores were associated with 30% lower odds of child vaccination. Understandably, parents might carefully weigh the benefits and risks regarding their child, as children were reported to be at little risk for severe COVID-19 infections and little information on child vaccinations was available at the time of the study. The more information a person seeks in order to weigh the risks and benefits of vaccination, the higher

Figure 2: Parental COVID-19 vaccination intention, by child age group (in %); n = 1318

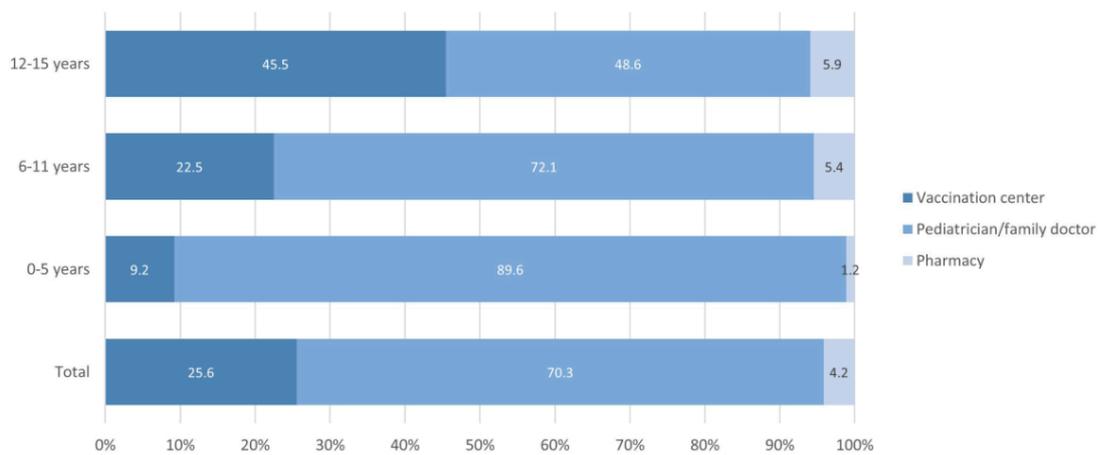
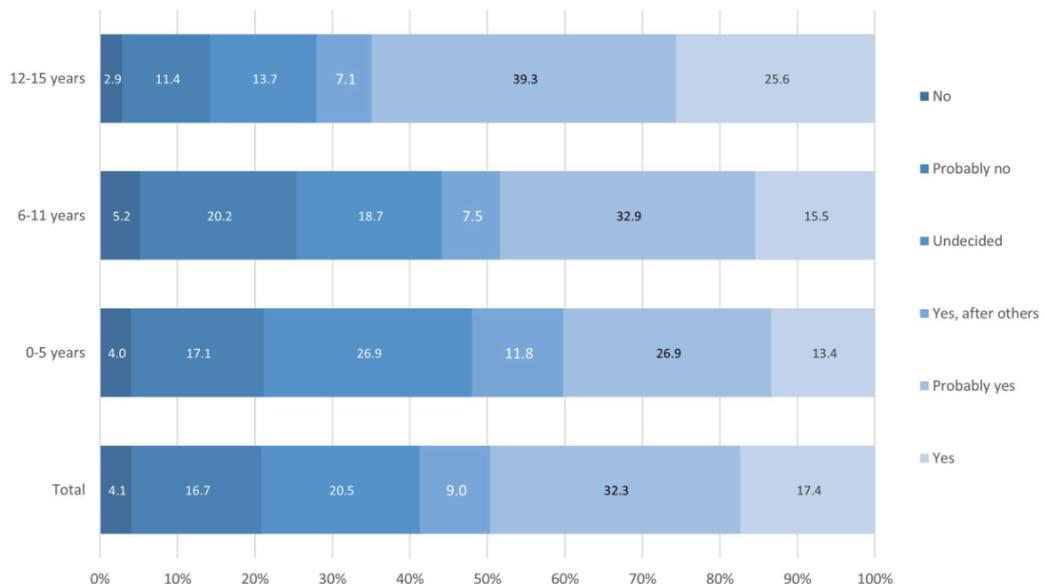


Figure 3: Parental preferred COVID-19 vaccination location for their child, by child age group (in %); n = 771.



the likelihood of encountering vaccine-critical information [15].

These findings emphasise that it is important to address the dimension of calculation when developing public health campaigns fostering COVID-19 vaccination for children from different angles and for different sub-groups. The parents indicating strong vaccination intentions (so-called innovators) should be reinforced in their conclusion, whereas the parents waiting for others to vaccinate their child first or who are yet undecided may react to positive experiences of the innovators in their decision-making process [33, 34]. Lastly, the ones who are against might need facts and figures, and background information to build trust in the recommendations.

Looking further into the covariates included in the full model (model 3), we found that being a father yields a significantly higher vaccination intention than being a mother. This is in line with results from Teasdale et al. [35], indicating that mothers were less likely to report plans to vaccinate their child against COVID-19. According to Bono et al. [36], women more often fear side effects and believe that the COVID-19 vaccine was designed to harm them or that the vaccine is not effective. These concerns may explain why women also tend to be more hesitant than men to get vaccinated against COVID-19 [28, 37–40].

A higher education level was positively associated with parental COVID-19 vaccination intention. A systematic review by Robinson et al. [41] indicated that generally, persons with a low education level are less likely to vaccinate against COVID-19. For parents with low education, some studies regarding childhood vaccinations (e.g., routine childhood, or influenza vaccinations) also showed a

higher hesitancy than parents with high education level [42, 43]. Nevertheless, Hudson and Motelpare [44] stressed that vaccine hesitancy is an issue across all social classes and vaccine campaigns should not be reduced to focus on lower socioeconomic status.

Our study showed that parents whose oldest child was between 12 and 15 years old have higher COVID-19 vaccination intention than parents with younger children. Parents whose child was over 11 years old had three-fold higher odds of intending to vaccinate their child. Our results must be viewed against the background of the absence of authorisation of the vaccine for children under 12 years at the time of the data collection in Switzerland and the limited availability of clinical study data for younger children. Similar findings were reported by Tensah et al. [45] as well as Teasdale et al. [35] and support our interpretation.

The COVID-19 vaccine was approved for 12-year-olds and older during the study in June 2021. We could thus investigate the impact of the authorisation on a change in intention. We found that parental COVID-19 vaccination intention decreased after the vaccine was approved for adolescents. This is contradictory to the hypothesis that the authorisation of the vaccine has a decisive role in vaccination intention. On the other hand, as time passed, people who attended the vaccination centre probably were different in their beliefs and attitudes toward the COVID-19 vaccination. The social pressure to get vaccinated against COVID-19 increased in the second half of 2021 [46] and as more restrictions came into force and the COVID certificate was introduced [47], people might have felt more inclined to be vaccinated for reasons other than collective responsibility or calculation.

Table 2:
Parental COVID-19 vaccination intention for children: logistic regression models.

Variable	Model 1		Model 2		Model 3	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
5C vaccination antecedents						
– Confidence	2.29***	1.80–2.91	1.41*	1.081.85	1.33†	1.001.76
– Complacency	0.76**	0.620.93	0.94	0.751.17	0.93	0.741.17
– Constraints	0.99	0.811.22	1.00	0.811.24	1.01	0.811.27
– Calculation	0.75***	0.650.87	0.78**	0.670.91	0.68***	0.580.81
– Collective responsibility	1.96***	1.542.49	1.79***	1.402.29	1.93***	1.472.52
Influenza vaccination (ref = No)						
– Yes			1.32*	1.011.72	1.53**	1.152.03
Travel vaccination (ref = No)						
– Yes			1.09	0.841.41	1.05	0.801.39
Conviction of the benefits of the vaccination recommendation			1.39***	1.301.50	1.40***	1.291.51
Age (years)					1.04**	[1.011.07]
Sex (ref = Women)						
– Men					1.66***	1.262.18
Education level (ref = Low)						
– Middle					1.14	0.741.76
– High					1.44†	0.972.14
Age oldest child under 16 years (ref = 0–5 years)						
– 6–11 years					1.14	0.811.60
– 12–15 years					2.93***	1.844.67
Time of vaccine authorisation (ref = Before authorization)						
– After authorisation					0.63**	0.480.83
Number of observations	1344		1340		1318	
P-value (chi-square)	<0.001		<0.001		<0.001	

ref = reference category; AOR = adjusted odds ratio; 95% CI = 95% confidence interval; † p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Our study participation rate was rather low, which can be explained by the recruiting method. The population invited to the vaccination centre was not informed about the study prior to their visit, nor were the individuals addressed directly at the centre. The QR code to the online link was placed on the floor in front of the seats and participants could find a leaflet next to the complimentary water bottles in the waiting zone. This cautious approach was taken to avoid any additional uncertainty regarding the vaccination at the centre. Therefore, our data are based on a self-selected sample, which limits the generalisability of our research findings. Since participants did not know we would also ask about child vaccinations, we see no major selection bias regarding parents' participation. Our 5C results show a variance, implying both vaccination hesitant and less hesitant parents participated in the study.

Conclusions

Our results imply that collective responsibility and calculation are strong drivers for parental vaccination intention. Campaigns on COVID-19 vaccination for children may reach parents better when addressing these psychological antecedents. Campaigns should also consider mothers as a specific target group because of their increased hesitancy. Strengthening confidence in official paediatric vaccination recommendations will increase compliance with recommendations in general, and is also predictive of a higher parental intention to vaccinate their child against COVID-19. Further, taking parental views on the setting for vaccination, paediatrician / family doctor practice or vaccination centres, into account may also have an effect on future parental vaccination willingness.

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Potential competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest was disclosed.

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Appendix: Supplementary table

Table S1:

Characteristics of the study population (n = 1318).

	Total n (%)	(Strong) vaccination intention ^a		p-value
		No n (%)	Yes n (%)	
Total	1318 (100.0)	544 (41.3)	774 (58.7)	
Vaccination intention				
– No	54 (4.1)	-	-	
– Probably no	220 (16.7)	-	-	
– Undecided	270 (20.5)	-	-	
– Yes, after others	119 (9.0)	-	-	
– Probably yes	426 (32.2)	-	-	
– Yes	229 (17.4)	-	-	
5C vaccination antecedents (mean) ^b				
– Confidence	4.43	4.19	4.60	<0.001
– Complacency	1.91	2.11	1.77	<0.001
– Constraints	1.44	1.45	1.41	0.014
– Calculation	3.87	4.04	3.75	<0.001
– Collective responsibility	4.52	4.28	4.69	<0.001
Influenza vaccination				<0.001
– No	841 (63.8)	391 (71.9)	450 (58.1)	
– Yes	477 (36.2)	153 (28.1)	324 (41.9)	
Travel vaccination				0.009
– No	521 (39.5)	238 (43.8)	283 (36.6)	
– Yes	797 (60.5)	306 (56.3)	491 (63.4)	
Conviction in the benefits of the vaccination recommendation (mean, SD) ^c	7.9 (2.2)	6.8 (2.4)	8.7 (1.6)	<0.001
Sex				0.011
– Women	590 (44.8)	266 (48.9)	324 (41.9)	
– Men	728 (55.2)	278 (51.1)	450 (58.1)	
Age (mean, SD)	41 (6.5)	39.7 (6.1)	42.1 (6.5)	<0.001
Education level				
– Low	204 (15.5)	111 (20.4)	93 (12.0)	<0.001
– Middle	316 (24.0)	152 (27.9)	164 (21.2)	
– High	798 (60.6)	281 (51.7)	517 (66.8)	
Age of oldest child under 16 years				<0.001
– 0–5 years	502 (38.1)	241 (44.3)	261 (33.7)	
– 6–11 years	465 (35.3)	205 (37.7)	260 (33.6)	
– 12–15 years	351 (26.6)	98 (18.0)	253 (32.7)	
Time of vaccine authorisation ^d				<0.001
– Before authorisation	521 (39.5)	148 (27.2)	373 (48.2)	
– After authorisation	797 (60.5)	396 (72.8)	401 (51.8)	
Preferred vaccination location (only participants willing to vaccinate their child)				
– Vaccination centre	197 (25.6)	-	-	
– Paediatrician or family doctor	542 (70.3)	-	-	
– Pharmacy	32 (4.2)	-	-	

Data are n (%) unless otherwise stated. n: number of observations

^a Strong vaccination intention: Yes = combined categories "Yes", "Yes, after others", "Probably yes"; No = combined categories "Undecided", "Probably no", "No"^b 5C vaccination antecedents: scale from 1 = strongly disagree to 5 = strongly agree^c Conviction in the benefits of the Swiss vaccination recommendation for children and adolescents: scale from 1 = not convinced at all to 10 = very convinced^d COVID-19 vaccines for children aged ≥12 years were approved in Switzerland on 4 June 2021