

Parental willingness to have children vaccinated against COVID-19 in Geneva, Switzerland: a cross-sectional population-based study

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Summary

OBJECTIVE: We aimed to examine factors associated with parental willingness to vaccinate their children against COVID-19.

METHODS: We surveyed adults included in a digital longitudinal cohort study composed of participants in previous SARS-CoV-2 serosurveys conducted in Geneva, Switzerland. In February 2022, an online questionnaire collected information on COVID-19 vaccination acceptance, parental willingness to vaccinate their children aged ≥ 5 years and reasons for vaccination preference. We used multivariable logistic regression to assess the demographic, socioeconomic and health-related factors associated with being vaccinated and with parental intention to vaccinate their children.

RESULTS: We included 1,383 participants (56.8% women; 69.3% aged 35–49 years). Parental willingness to vaccinate their children increased markedly with the child's age: 84.0%, 60.9% and 21.2%, respectively, for parents of adolescents aged 16–17 years, 12–15 years and 5–12 years. For all child age groups, unvaccinated parents more frequently indicated not intending to vaccinate their children than vaccinated parents. Refusal to vaccinate children was associated with having a secondary education (1.73; 1.18–2.47) relative to a tertiary education and with middle (1.75; 1.18–2.60) and low (1.96; 1.20–3.22) household income relative to high income. Refusal to vaccinate their children was also associated with only having children aged 12–15 years (3.08; 1.61–5.91), aged 5–11 years (19.77; 10.27–38.05), or in multiple age groups (6.05; 3.22–11.37), relative to only having children aged 16–17 years.

CONCLUSION: Willingness to vaccinate children was high for parents of adolescents aged 16–17 years but decreased significantly with decreasing child age. Unvaccinated, socioeconomically disadvantaged parents and those with younger children were less likely to be willing

to vaccinate their children. These results are important for vaccination programs and developing communication strategies to reach vaccine-hesitant groups, both in the context of COVID-19 and in the prevention of other diseases and future pandemics.

Introduction

Vaccination against COVID-19 has proven efficacy to reduce transmission, limit disease severity, and prevent hospitalisations and post-COVID syndrome, including in children as young as five years [1–4]. Mass vaccination in Switzerland began on 23 December 2020, with priority given to individuals aged 65 years and older, those with chronic diseases deemed ‘particularly vulnerable to COVID-19’ and health workers. Subsequently, vaccination eligibility progressively extended to include all persons aged ≥ 16 years (May 2021), children aged ≥ 12 years (June 2021) and children aged ≥ 5 years (December 2021) [5]. Since vaccines became available, public and scientific debate has been ongoing on the need for and relevance of vaccinating children, whereas the vaccination of adolescents is strongly recommended and generally accepted [6–8]. Although the disease burden (infection severity and short-term effects) in children and adolescents has been relatively low, when infected with SARS-CoV-2, they can transmit the virus to others [9]. Children and adolescents with COVID-19 have a low risk of multisystemic inflammatory syndrome [10] and a low to moderate risk of long COVID [11–13], but they may face educational disruptions, social isolation and poor wellbeing [14–16]. Available vaccination data highlight the safety of the COVID-19 vaccination among children and adolescents [3, 17, 18]. In Switzerland, COVID-19 vaccination is recommended for children and adolescents to protect them from severe forms of COVID-19 and post-COVID syndrome [2, 19]. It is also highly recommended for children and adolescents with a chronic illness and those who are in close contact with others at high risk, such as people with a weakened immune

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system [20]. In addition, from a public health perspective, vaccination among children and adolescents will de facto increase general vaccination coverage and potentially reduce viral circulation in the population.

Worldwide, parental willingness to vaccinate their children for common childhood diseases varies greatly across populations, often depending on psychosocial, sociocultural, socioeconomic and political factors [21–23]. Understanding the factors associated with parental willingness to vaccinate children is important for tailoring vaccination campaigns with the objective of an overall vaccination increase. Among adults, COVID-19 vaccine acceptance has evolved since the beginning of the pandemic as a function of its evolution and the establishment of containment measures [24–26].

As the pandemic continues, with new variants driving new waves of transmission, and the immune landscape in the population shows decreasing immune protection against emerging variants, vaccination will continue to play a key role in minimising infections, protecting health care workers and vulnerable patients and preventing overburdening health care systems. Monitoring the level of vaccination acceptance in the population, including among children and adolescents, is essential for this. This study aimed to examine parental willingness to have children vaccinated against COVID-19 and explored potentially related sociodemographic factors.

Methods

Study design, setting and sample

This study was embedded in the longitudinal digital cohort study Specchio-COVID19. The cohort was launched in December 2020 to follow the participants of COVID-19 serosurveys conducted in the canton of Geneva, Switzerland. Its main objective is to monitor COVID-19-related symptoms, SARS-CoV-2 seroconversion, and the overall impact of the pandemic on several dimensions of health and socioeconomic factors for at least 2 years [27]. The participants were randomly selected from the general population at three time points: for the first serosurvey, April–June 2020, participants aged 20–75 years were enrolled from a previous general health survey (Bus Santé) representative of the population of Geneva [25]; for the second and third serosurveys (November–December 2020 and June–July 2021), participants were recruited from random samples provided by the Federal Statistics Office of individuals living in Geneva aged 0–64 years [29, 30].

Following participation in one of these serosurveys, participants were invited to join the Specchio-COVID19 cohort study, consisting of periodic online questionnaires and potential serological follow-up [31]. Upon registration, an initial questionnaire collected sociodemographic and lifestyle characteristics and general health-related information. Self-reported SARS-CoV-2 infections and vaccination status were updated through monthly questionnaires. The vaccination questionnaire designed for this study was sent out to participants on 15 February 2022, five weeks after vaccination became available for children aged ≥ 5 years. Responses up to 13 March 2022 were included in the analysis. Data on the age, sex and education distribution in the overall population of the canton of Geneva were

obtained from the Cantonal Office of Statistics of Geneva [32].

Data collected in the COVID-19 vaccination questionnaire

For all participants, the questionnaire collected information regarding COVID-19 vaccination status, acceptance and perceived utility of vaccination in children. For those with children aged 5–17 years, supplementary questions collected information about their willingness to have their children vaccinated against COVID-19 and their reasons for or against this.

The demographic and socioeconomic variables were categorised as follows: education as primary (compulsory education or no formal education), secondary (apprenticeships, secondary school and specialised schools) and tertiary education (university degree, higher professional education and doctorates); income, according to household composition-specific categories from cantonal household income statistics [33], as low (below the first quartile of the general population), middle (between the first and third quartiles) and high (above the third quartile), considering both self-reported household income and household composition (living alone with or without children, in a relationship with or without children, or in a shared apartment with other adults) from the baseline questionnaire; birth country as Switzerland, other high-income country, and low- or middle-income country; employee status as employee, independent, unemployed, retired and other economically inactive; having a chronic disease as yes/no; household composition as alone, single with children, with partner and children, and living with others but not children; smoking status was current, former and never. We categorised having children into four age-based groups: only 5–11 years, only 12–15 years, only 16–17 years, and mixed ages.

As an outcome, vaccination status was defined as yes/no according to the question “Have you received at least one dose of the COVID-19 vaccine?” Intention to vaccinate children was defined as “intend to or already vaccinated”, “do not know” and “not intending to”.

Statistical analysis

In descriptive statistics, we reported the number and percentage for categorical variables and the median and interquartile range (IQR) for continuous variables. We used logistic regression to assess the association of demographic, socioeconomic and health-related factors with COVID-19 vaccination status. Logistic regression models were run for all the following variables, adjusting for sex and age: education, household income, employment status, household composition, having a chronic disease and smoking status. For each variable, we also ran multivariable logistic regressions adjusting for age, sex, education ($n = 1$ missing) and income ($n = 3$ missing; $n = 790$ unknown/unwilling to respond and excluded from analyses). A multinomial regression model was used to assess the relationship between the predictor variables (age, sex, education, income, child’s age group) and the willingness of parents to have their children vaccinated. All regression models were complete case analyses. Odds ratios (ORs)

and 95% confidence intervals (95% CIs) were calculated through the exponentiation of estimated coefficients. Statistical significance was taken at the level of $p < 0.05$ *a priori*. All analyses were conducted using R 4.1.1 (R Foundation for Statistical Computing, Vienna, Austria), distributed under the GNU General Public License. The code used in the regression analyses is available at <https://github.com/UEP-HUG/2022-vacc-opinion-public>.

Ethical considerations

All participants of the Specchio-COVID19 longitudinal study provided informed and written consent upon enrolment in the study. Ethical approval for the study was obtained from the Cantonal Research Ethics Commission of Geneva, Switzerland (project number 2020-00881). The protocol of the overarching study (Specchio-COVID19) has been published elsewhere [31].

Results

Sample characteristics

Of the 6,816 individuals invited, 4,275 chose to participate (62.7% overall response rate; see supplementary Table 1), of whom 1,383 participants (1/3 of the total sample) were parents of children aged 5–17 years and constituted our analytical sample. Among these, 69.3% were aged 35–49 years, and 56.8% were women. Most participants were professionally active (88.2%), had completed tertiary education (73.6%) and reported a middle household income (51.3%; table 1). Among participants with children aged 16–17 years, 87.0% reported that their children were already vaccinated. This decreased to 65.5% among those with children aged 12–15 years and 8.7% among participants with children aged 5–11 years. For a description of the overall sample and a comparison to the general population of Geneva, see supplementary tables 2–4. For an overview of sociodemographic factors associated with vaccination status in the overall sample, see supplementary tables 5–6.

Willingness of parents to have children vaccinated against COVID-19

Parental intention to vaccinate their children differed considerably according to their children's age group (with a marked decrease in younger age groups) and their own vaccination status (figure 1, supplementary table 7). Overall, 13.4% of parents with adolescents aged 16–17 years indicated no intention to vaccinate them, 2.6% indicated being undecided and 84.0% indicated their children had already received the vaccine. Among parents of children aged 12–15 years, 31.0% indicated having no intention to vaccinate their children, 7.0% indicated being undecided and 60.9% indicated having already vaccinated their children. Among parents with children aged 5–11 years, 59.6% indicated having no intention to vaccinate them, 20.9% indicated not knowing yet and 21.2% indicated having already vaccinated their children or intending to (supplementary table 7). For all child age groups, unvaccinated parents indicated not intending to vaccinate their children more frequently than vaccinated parents did (figure 1).

Sociodemographic factors associated with parental intention to vaccinate children against COVID-19

In comparison with those willing to have their children vaccinated, regardless of age, parents with secondary or primary education, and those with middle or low household income levels, had greater odds of refusing COVID-19 vaccination for their children or deciding differently depending on the child's age (table 2). No association existed with the parent's sex, whereas being a younger parent was associated with willingness to have children vaccinated, whatever their age (table 2).

Compared with parents who had children only in the 16–17 years age group, parents with children only in the 12–15 years age group had three times greater odds of refusing to have their children vaccinated (3.08; 1.61–5.91); parents with children only in the 5–11 years age group had almost 20 times greater odds of refusing to have their children vaccinated (19.8; 10.3–38.1).

Reasons for parental intention for or against vaccinating children

Among parents in favour of vaccinating their children, the most frequently chosen reason was “wish my child to be able to lead a normal life (go to school, do activities, travel, etc.)”, reported by more than three quarters of parents, regardless of their child's age group (figure 2). The other most reported reasons varied in frequency according to the child's age group. For instance, the intention to vaccinate children to protect them against long COVID symptoms was reported by 51.5% of parents with children aged 16–17 years, 55.8% of parents with children aged 12–15 years and 74.7% of parents with children aged 5–11 years. Similarly, protection against SARS-CoV-2 infection was reported as a reason by 49.4%, 56.1% and 71.8% of parents with children aged 16–17 years, 12–15 years and 5–11 years, respectively. With a similar frequency according to the child's age group, over half of the parents also reported “to get out of the public health crisis more quickly” and “wish to protect those close to my child (grandparents or other family members)” as reasons for vaccinating their children (figure 2).

Among parents not intending to vaccinate their children, “my child has already had COVID-19” was reported by 74.2%, 55.3% and 66.0% of those with children aged 16–17 years, 12–15 years and 5–11 years, respectively (figure 3). A “worry about lack of long-term knowledge regarding COVID-19 vaccines” was reported by 59.7%, 60.2% and 44.3% of parents with children aged 16–17 years, 12–15 years and 5–11 years, respectively. A “worry about COVID-19 vaccines' side effects” was reported by 54.8%, 44.7% and 36.0% of parents with children aged 16–17 years, 12–15 years and 5–11 years, respectively. “My child does not want to get vaccinated” was reported by 41.9%, 35.2% and 16.2% of parents with children aged 16–17 years, 12–15 years and 5–11 years, respectively. Very few participants reported being against vaccines in general (figure 3).

Discussion

To our knowledge, this is the first population-based study in Switzerland to assess parental willingness to have their children vaccinated against COVID-19 since vaccination was officially approved for children and adolescents. Our study began 5 to 8 weeks after vaccination became available to all children aged ≥ 5 years. We found that parental willingness to have their children vaccinated differed considerably according to their children's age and their own vaccination status.

A recent meta-analysis of 44 studies worldwide, most of which were conducted before vaccination was approved for children and adolescents, found that parental intention to vaccinate their children was 60.1% overall, although it ranged from 25.6% in Saudi Arabia to 92.2% in Zambia

[8]. This meta-analysis also found that, overall, 22.9% of participants intended not to vaccinate their children, and 25.8% were unsure [8].

In our previous cross-sectional vaccination survey, conducted before vaccination was available for children, we showed that less than half of parents (45.6%) intended to have their children vaccinated in the canton of Geneva. The gradient in intention increased with children's age from 38.6% for children aged 6–10 years to 55.9% for children aged 16–18 years [24]. In a sample of Swiss German-speaking parents, 58.7% reported their intention to have their children vaccinated. However, this result might be overestimated because parents were recruited at a vaccination centre [34].

Table 1:
Sociodemographic and health-related characteristics of the study participants.

Sociodemographic characteristics ¹		Participants with children aged 5–17 years, n (%)
N		1383
Sex	Female	785 (56.8)
	Male	592 (42.8)
	Other	6 (0.4)
Age category, years	18–34	49 (3.5)
	35–49	958 (69.3)
	50–64	364 (26.3)
	≥ 65	12 (0.9)
Birth country	Switzerland	744 (55.4)
	Other high-income country	442 (33.0)
	Low-income country	155 (11.6)
Employment status	Employee	1098 (79.4)
	Independent	122 (8.8)
	Unemployed	41 (3.0)
	Retired	17 (1.2)
	Other economically inactive	105 (7.6)
Education	Primary	39 (2.8)
	Secondary	324 (23.4)
	Tertiary	1017 (73.6)
	Other	2 (0.1)
Household income ²	High	224 (16.2)
	Middle	709 (51.3)
	Low	237 (17.2)
	Don't know/don't wish to answer	211 (15.3)
Chronic disease (parent)	Yes	282 (20.4)
	No	1101 (79.6)
Household composition	Alone	15 (1.1)
	Single parent with children	149 (10.8)
	With partner and children	1187 (85.9)
	Living with others but no children	31 (2.2)
Smoking status	Current smoker	210 (15.2)
	Former smoker	408 (29.5)
	Never smoker	764 (55.3)
Having children	Only children 5–11	530 (38.3)
	Only children 12–15	238 (17.2)
	Only children 16–17	177 (12.8)
	Children of mixed age groups	438 (31.7)
Having children already vaccinated ³	Only children 5–11	46 (8.7)
	Only children 12–15	156 (65.5)
	Only children 16–17	154 (87.0)
	Children of mixed age groups	278 (63.5)

¹ Some data are excluded due to very low numbers. Missing data counts: birth country 42; education 1; household income 2; household composition 1; smoking status 1.

² Income category was calculated based on the reported household composition (alone, with partner, with or without children, with other adults) and household income.

³ n and percentages represent number of parents with vaccinated children in these age groups.

These new findings reflect those of international studies conducted since vaccination was approved for children aged 12 years and older. A Canadian study found that around 90% of parents had already vaccinated or were very

likely to vaccinate their children aged 12–17 years, whereas more than half were willing to vaccinate their younger children (0–11 years) [35]. In the US, a study found that around two thirds of parents had already vaccinated or in-

Figure 1: Parental intention to vaccinate children by age group and own vaccination status. Parental vaccination status is positively associated with their intention to have their children vaccinated, across all age groups, though this association was weakest for the 5–11 years age group. “Vacc.” means parents having received at least one vaccine dose (those with at least one child aged 5–11 n = 705; 12–15 n = 548; 16–17 n = 339), and “Non-vacc.” refers to non-vaccinated parents (5–11 n = 126; 12–15 n = 97; 16–17 n = 48). If a parent has children in more than one age group, they are counted twice in the figure.

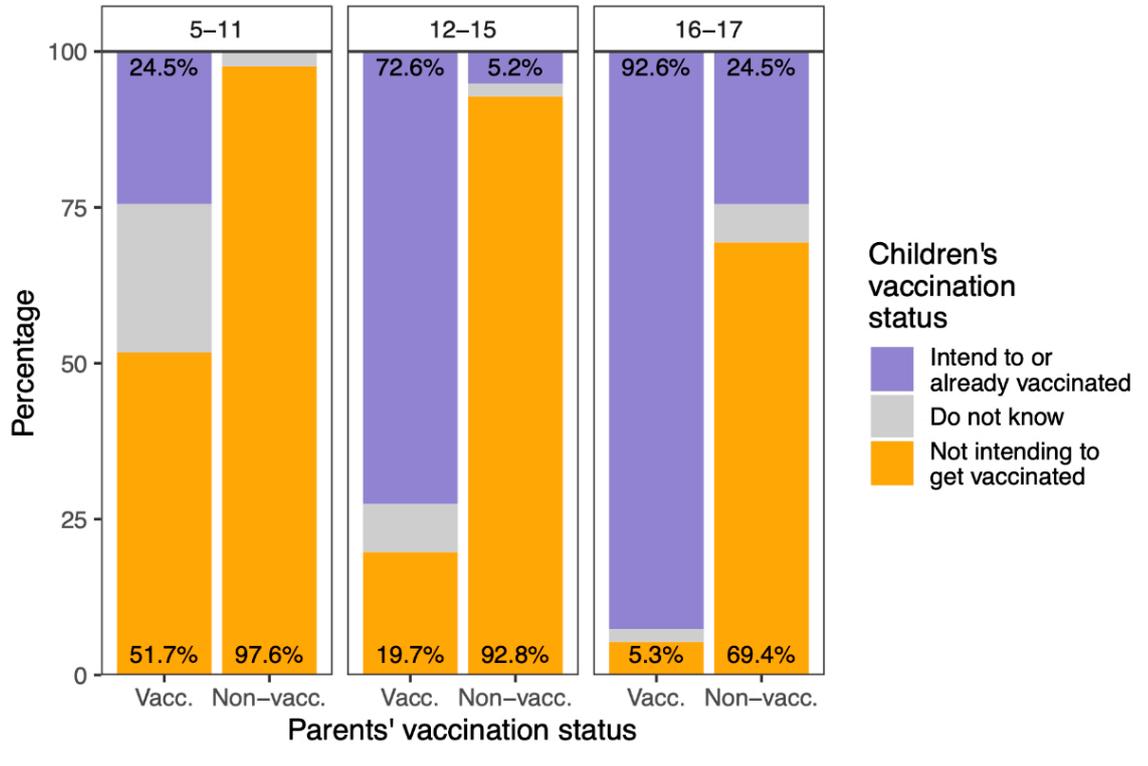


Table 2. : Association between sociodemographic factors and parental intention to vaccinate children.

Estimates (odds ratio and 95% confidence interval) are from multinomial logistic regression, mutually adjusted for all variables presented in this table. Reference categories are female sex, tertiary educational level, high household income, and having children in only the 16–17 years age group. The analytical sample for complete case multinomial model was n = 1,162.

		Parental intention to have their children vaccinated ^a			
		Depends on child's age ^b vs always		Never ^c vs always	
		OR (95% CI)	p-value	OR (95% CI)	p-value
Age, years		0.96 (0.93–0.99)	0.01	0.96 (0.93–0.98)	0.001
Sex	Female	1.00 (ref.)		1.00 (ref.)	
	Male	1.15 (0.80–1.64)	0.45	0.90 (0.66–1.23)	0.52
Education level	Tertiary	1.00 (ref.)		1.00 (ref.)	
	Secondary	1.24 (0.79–1.95)	0.35	1.71 (1.18–2.47)	0.004
	Primary	2.56 (0.88–7.44)	0.08	1.21 (0.42–3.46)	0.73
Household income	High	1.00 (ref.)		1.00 (ref.)	
	Middle	1.52 (0.97–2.37)	0.07	1.75 (1.18–2.60)	0.005
	Low	1.60 (0.90–2.85)	0.11	1.96 (1.20–3.22)	0.008
Children's age group	16–17 years only	1.00 (ref.)		1.00 (ref.)	
	12–15 years only	2.46 (0.86–7.02)	0.09	3.08 (1.61–5.91)	0.001
	5–11 years only	19.4 (7.22–52.14)	<0.001	19.77 (10.27–38.05)	<0.001
	Multiple ^d	17.3 (6.73–44.68)	<0.001	6.05 (3.22–11.37)	<0.001

^a The reference category for parental intention to have their children vaccinated corresponds to parents who already had vaccinated all their children of any age group or intended to do so.

^b This category indicates parents who were undecided on vaccinating all their children of any age group or who had vaccinated or intended to vaccinate their children in one age group only (and refused to vaccinate their children of another age group).

^c This category indicates parents who were against vaccinating their children of any age group.

^d This category indicates parents with children of different age groups.

tended to vaccinate their children aged 12–17 years, and 60% intended to vaccinate their children aged 5–11 years [36]. In both studies, similarly to our findings, parents were significantly more likely to vaccinate their children if they were themselves vaccinated [35, 36].

Our findings are also in line with those of previous studies showing that parental willingness to vaccinate their children decreased progressively with the age of the child, from 84.0% for parents of children aged 16–17 years to

19.5% for parents of children aged 5–11 years [8, 34–36]. However, in the studies from the US and Canada, these decreases were not as pronounced as in our findings [35, 36]. The COVID certificate was established for adolescents aged 16 years or above in Switzerland, and for those aged 12 years or above in neighbouring France, which likely explains why around three quarters of parents reported choosing to vaccinate their children so they could “lead a normal life”. Similar to reports regarding willingness to

Figure 2: Reasons for deciding or wanting to vaccinate children. Parents of children in the given age groups were asked their reasons for deciding or intending to vaccinate their children. Multiple choices were possible. Parents of children aged 5–11 years were not asked about the need for a COVID certificate because this age group did not require one for any activities in Switzerland.

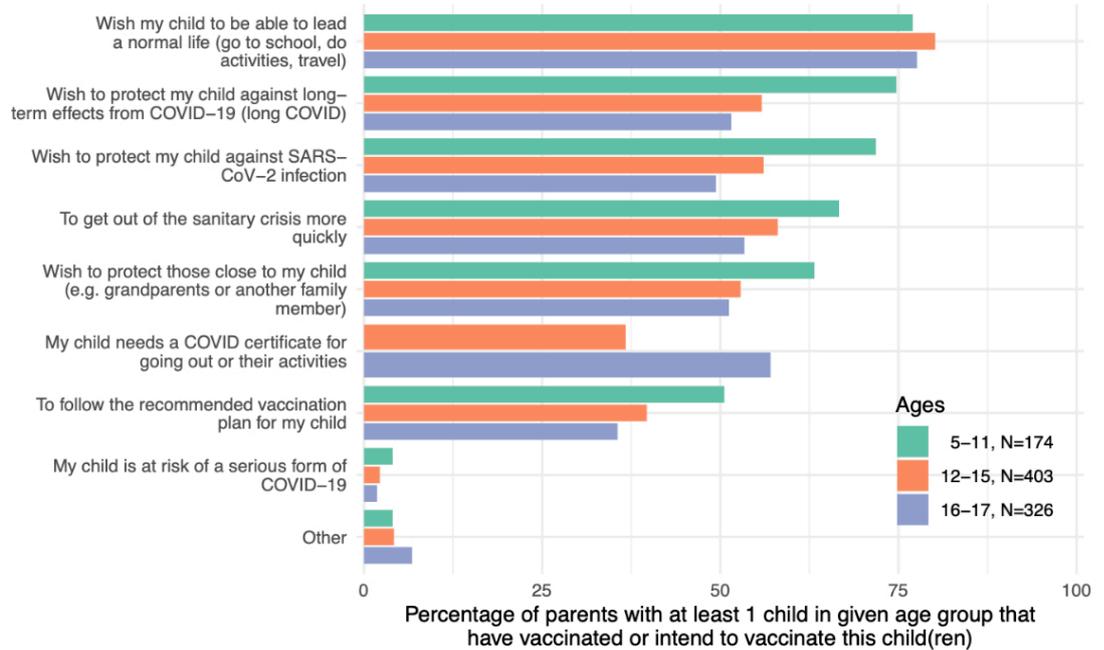
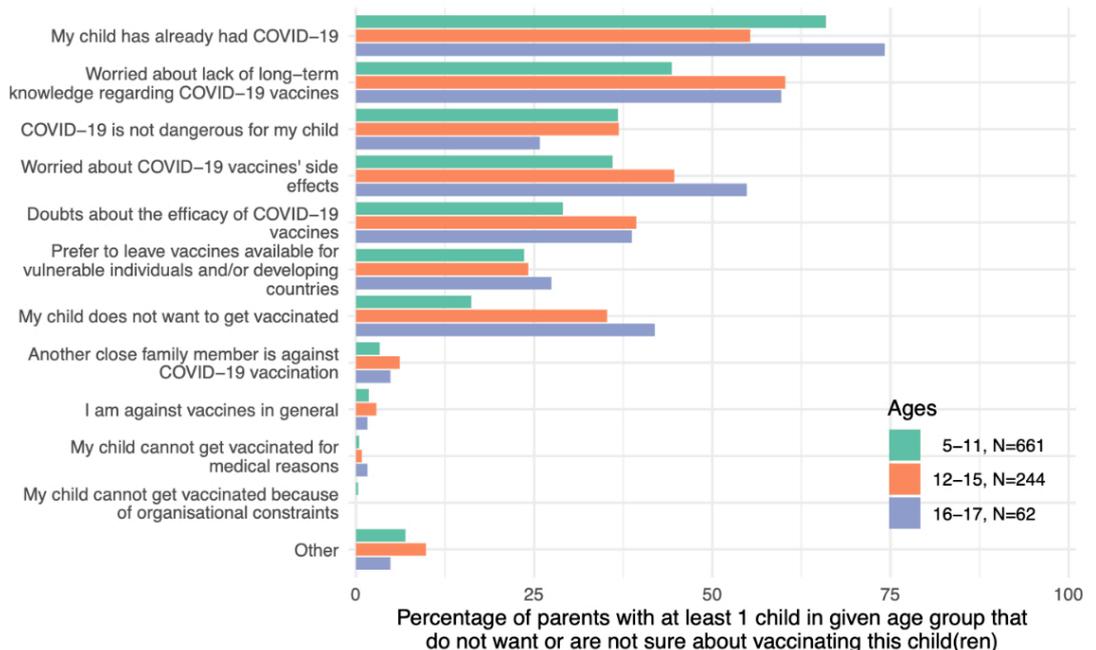


Figure 3: Reasons for deciding not to vaccinate children. Parents of children in the given age groups were asked their reasons for not wanting to vaccinate or not being sure about vaccinating their children. Multiple choices were possible.



vaccinate children against other diseases, we found that perceived vaccine safety was an important determinant of acceptance [37, 38]. In addition, in Switzerland, vaccination is not recommended for children who have already had COVID, which likely explains this reason being the most frequently reported among parents not intending to vaccinate their children.

As reported in other countries, we found that higher parental education and household income levels were associated with a higher likelihood of vaccinating children. Although we found no association with the parent's sex, previous studies reported that fathers were more likely to intend to vaccinate their children, with mothers more concerned about the potential undesirable side effects [8, 34–36]. This lack of association may be because women were overrepresented in our sample.

Parental hesitancy to vaccinate their children against COVID-19 appears to be higher compared with other recommended vaccines, although our study did not consider vaccine hesitancy for children aged <5 years. For instance, a recent nationwide survey in Switzerland found that 26% of parents were vaccine-hesitant regarding the official recommendations for polio–pertussis–tetanus and measles vaccines during the first year of life [39, 40]. Notably, our results showed that even among parents not intending to vaccinate their children against COVID-19, only a small proportion (<5%) reported being against vaccines in general.

Implications for public health policies

As the pandemic enters new phases, with newly emerging virus variants driving new waves and exerting variable pressure on health systems, maintaining and reinforcing prevention strategies remains important, particularly including the vaccination of children and adolescents. Information campaigns must still emphasise that even though vaccines' effectiveness in preventing infections can decrease over time and with the emergence of new variants of concern, they still confer a high level of protection against severe COVID-19, hospitalisation and death [2, 4]. Vaccination of children and adolescents remains an essential component of the prevention of severe COVID-19 and hospitalisation, as well as preventing long COVID and psychosocial and educational difficulties. As such, given the decreased willingness to vaccinate younger children, vaccination programs must frame their outreach message, particularly for socioeconomically disadvantaged parents, who are less likely to vaccinate their children. Identifying specific groups with the lowest level of acceptance of further COVID-19 vaccination is essential for effective science and public health communication, building general trust in vaccines and tackling socioeconomic inequalities. This will, in turn, strengthen other vaccination campaigns and prepare for future pandemics.

Strengths and limitations

The main strengths of this study are its population-based sample and the inclusion of data on sociodemographic and health-related characteristics, which allowed analysis of COVID-19 vaccination acceptance according to these factors. Importantly, participants were interviewed 6–10

weeks after vaccination was approved for children aged ≥ 5 years, which enabled their opinions to be based on real-life conditions instead of hypothetical vaccination of their children.

Several limitations of our study should be acknowledged. Although the participation rate in this study was relatively high, generalisation of the results presented here requires caution because our sample is not completely representative of the general adult population of the canton of Geneva. Our participants were older and had a higher level of education than the general adult population – a common characteristic of epidemiological population-based studies [41]. Participation required French literacy, internet access and digital literacy, potentially excluding part of the general population. Some other factors that may impact vaccination acceptance were not investigated, such as religious or political views, social network influence, and other indicators of socioeconomic conditions that are likely to influence individual perceptions and behaviour. Parents' decisions regarding vaccination can also be influenced by their health care providers. In addition, especially for children and adolescents, we do not know about the presence of chronic diseases, which can impact the willingness of parents to have them vaccinated.

Conclusion

Parental willingness to vaccinate their children was high for adolescents aged 16–17 years, but it decreased considerably for younger adolescents and was markedly lower among unvaccinated parents. Underprivileged socioeconomic conditions were associated with being unvaccinated among adults and not intending to vaccinate their children. Given the proven efficacy of COVID-19 vaccines in preventing severe disease and hospitalisation, our results should be considered in designing future vaccination hesitancy research and in the communication and outreach strategies of vaccination programs targeting vaccine-hesitant groups.

Data availability statement

Coded study data that underlie the results reported in this article can be made available to the scientific community after deidentification and upon submission of a data request application to the investigators' board via the corresponding author. The protocol of the overarching study (Specchio-COVID19) can be found at <https://bmjopen.bmj.com/content/12/1/e055515>.

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Authors' contributions: HB, SS and IG designed the study. HB and SS designed the questionnaire for the survey. MEZ, CS and FP were involved in participant recruitment and implementation of the survey. NP conducted statistical analyses of the data. HB and CdM drafted the manuscript. EL and ALH reviewed the manuscript. All authors participated in the analysis interpretation and reviewed and approved the final manuscript.

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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 1. Response rates, overall and by age group in total sample

	Invited, n	Responded, n	Response rate, %
Total	6816	4275	62.7
Age groups, in years			
18-34	1144	428	37.4
35-49	2252	1249	55.5
50-64	2173	1570	72.3
≥65	1247	1058	84.8

Supplementary table 2. Socio-demographic and health-related characteristics of the study participants

Socio-demographic characteristics ¹	All respondents n (%)	Parents of children aged 5-17 years, n (%)
N	4275	1383
Sex		
Female	2443 (57.2)	785 (56.8)
Male	1818 (42.5)	592 (42.8)
Other	14 (0.3)	6 (0.4)
Age category, years		
18-34	487 (11.4)	49 (3.5)
35-49	1302 (30.5)	958 (69.3)
50-64	1525 (35.7)	364 (26.3)
≥ 65	961 (22.5)	12 (0.9)
Birth country		
Switzerland	2588 (62.4)	744 (55.4)
Other high-income country	1185 (28.6)	442 (33.0)
Low-income country	372 (9.0)	155 (11.6)
Employment status		
Employee	2415 (56.5)	1098 (79.4)
Independent	322 (7.5)	122 (8.8)
Unemployed	131 (3.1)	41 (3.0)
Retired	1013 (23.7)	17 (1.2)
Other economically inactive	393 (9.2)	105 (7.6)
Education		
Primary	141 (3.3)	39 (2.8)
Secondary	1311 (30.7)	324 (23.4)
Tertiary	2809 (65.7)	1017 (73.6)
Other	13 (0.3)	2 (0.1)
Household income²		
High	622 (14.6)	224 (16.2)
Middle	2270 (53.1)	709 (51.3)
Low	590 (13.8)	237 (17.2)
Don't know/don't wish to answer	790 (18.5)	211 (15.3)
Chronic disease (parent)		
Yes	1122 (26.2)	282 (20.4)
No	3153 (73.8)	1101 (79.6)
Household composition		
Alone	628 (14.7)	15 (1.1)
Single parent with children	263 (6.2)	149 (10.8)
With partner and children	1834 (42.9)	1187 (85.9)
Living with others but no children	1549 (36.2)	31 (2.2)
Smoking status		
Current smoker	640 (15.0)	210 (15.2)
Former smoker	1321 (30.9)	408 (29.5)
Never smoker	2313 (54.1)	764 (55.3)
Having children		
None of ages 5-17	2892 (67.7)	--
Only children 5-11	530 (12.4)	530 (38.3)
Only children 12-15	238 (5.6)	238 (17.2)
Only children 16-17	177 (4.1)	177 (12.8)
Having children of mixed age groups	438 (10.3)	438 (31.7)
Having children already vaccinated³		
Only children 5-11	46 (8.7)	46 (8.7)
Only children 12-15	156 (65.5)	156 (65.5)
Only children 16-17	154 (87.0)	154 (87.0)
Having children of mixed age groups	278 (63.5)	278 (63.5)

¹ Some data are excluded due to very low numbers. Missing data counts as follows: Birth country 130/42 (all respondents/parents of children aged 5-17); Education 1/1; Household income 3/2; Employment status 1/0; Household composition 1/1; Smoking status 1/1.

² Income category was calculated based on the reported household composition (alone, with partner, with or without children, with other adults) and household income.

³ n and percentages represent number of parents with vaccinated children in these age groups.

Supplementary table 3. Characteristics of study participants* and of the general adult population of Geneva, Switzerland

Age	Women, n (%)		Men, n (%)		Overall, n (%)	
	Geneva population	Study sample	Geneva population	Study sample	Geneva population	Study sample
18-24	21000 (5.0)	90 (2.1)	20899 (5.0)	45 (1.1)	41899 (10.1)	135 (3.2)
25-44	76149 (18.3)	711 (16.7)	74120 (17.8)	390 (9.2)	150269 (36.1)	1101 (25.8)
45-64	70931 (17.0)	1170 (27.5)	68299 (16.4)	897 (21.1)	139230 (33.4)	2067 (48.5)
≥65	49038 (11.8)	472 (11.1)	35886 (8.6)	486 (11.4)	84924 (20.4)	958 (22.5)
Educational						
Primary	46496 (14.1)	76 (1.8)	34967 (10.6)	51 (1.2)	81463 (24.7)	127 (3.1)
Secondary	53568 (16.2)	751 (18.3)	48195 (14.6)	475 (11.5)	101763 (30.8)	1226 (29.8)
Tertiary	73552 (22.3)	1516 (36.9)	73551 (22.3)	1244 (30.2)	147103 (44.5)	2760 (67.1)

*"Other" sex individuals were not included in this table due to lack of data on this category in the statistics of the canton of Geneva. The combined Women and Men columns sum up to 100%.

Supplementary table 4. Characteristics of overall sample participants and of non-respondents

Socio-demographic characteristics	Participants n (%)	Non-respondents n (%)	p-value
Sex			<i>0.21</i>
Female	2443 (57.1)	1410 (55.2)	
Male	1818 (42.5)	1133 (44.3)	
Other	14 (0.3)	12 (0.5)	
Age, median (IQR)	52.0 (43.0-63.0)	43.0 (33.0-54.0)	<i><0.001</i>
Education			<i><0.001</i>
Primary	141 (3.3)	213 (8.3)	
Secondary	1311 (30.7)	792 (31.0)	
Tertiary	2809 (65.7)	1547 (60.6)	
Household income¹			<i><0.001</i>
Low	590 (13.8)	449 (17.6)	
Middle	2270 (53.1)	1103 (43.3)	
High	622 (14.6)	322 (12.6)	
Don't know/don't wish to answer	790 (18.5)	676 (26.5)	
Chronic disease			<i><0.001</i>
Yes	1122 (26.2)	509 (19.9)	
No	3153 (73.8)	2045 (80.1)	
Employment status			<i><0.001</i>
Employee	2415 (56.5)	1544 (60.5)	
Retired	1013 (23.7)	184 (7.2)	
Independent	322 (7.5)	173 (6.8)	
Unemployed	131 (3.1)	129 (5.1)	
Living conditions			<i><0.001</i>
Alone	628 (14.7)	245 (9.6)	
Single parent with children	263 (6.2)	166 (6.5)	
With partner and children	1834 (42.9)	1257 (49.3)	
With partner or other, without children	1549 (36.2)	884 (34.6)	
Smoking status			<i><0.001</i>
Never smoker	2313 (54.1)	1428 (55.9)	
Former smoker	1321 (30.9)	565 (22.1)	
Current smoker	640 (15.0)	560 (21.9)	

¹ Income category was calculated based on household composition (alone, with partner, with or without children, with other adults) and reported household income.

Supplementary table 5. Vaccination rate and reasons for refusing to receive a booster dose

	Vaccinated participants n (%)
Received ≥ 1 vaccine dose	3830 (89.6)
Received vaccine doses included booster shot	
Yes	2913 (76.1)
No	917 (23.9)
Intention to receive booster shot	
Yes/rather yes	195 (21.3)
No/rather no	674 (77.9)
Reasons for not intending to receive booster shot	
"I currently have enough antibodies"	292 (40.9)
"I have lost trust in the vaccine's efficacy"	244 (34.2)
"Other"	240 (33.6)
"I experienced too many undesirable effects after the last received dose"	106 (14.9)
"Vaccination has resulted in long-lasting/permanent negative effects on my health"	42 (5.9)
"I currently have COVID-19"	39 (5.5)
"I had a strong reaction to the vaccine"	29 (4.1)

Supplementary table 6. Association of socio-demographic and health-related factors with vaccination status of adults in overall sample

Sociodemographic characteristics ¹	Vaccination status		Age- and sex-adjusted OR [†] (95% CI)	Multivariable OR ^{**†} (95% CI)
	Vaccinated n (%)	Unvaccinated n (%)		
N	3830	445 (10.4)		
Age			1.03 (1.02-1.03)	1.03 (1.02-
Sex				
Female	2165	278 (62.5)	1.00 (ref.)	1.00 (ref.)
Male	1653	165 (37.1)	1.18 (0.97-1.46)	1.19 (0.94-
Other	12 (0.3)	2 (0.4)	-	-
Education				
Tertiary	2565	244 (54.8)	1.00 (ref.)	1.00 (ref.)
Secondary	1127	184 (41.3)	0.55 (0.45-0.68)	0.60 (0.47-
Primary	126 (3.3)	15 (3.4)	0.81 (0.48-1.47)	0.74 (0.41-
Other	11 (0.3)	2 (0.4)	-	-
Household Income²				
High	589 (15.4)	33 (7.4)	1.00 (ref.)	1.00 (ref.)
Middle	2053	217 (48.8)	0.50 (0.34-0.73)	0.53 (0.36-
Low	506 (13.2)	84 (18.9)	0.35 (0.23-0.53)	0.40 (0.26-
Don't know/ don't wish to answer	679 (17.7)	111 (24.9)	-	-
Employment status				
Employee	2130	285 (64)	1.00 (ref.)	1.00 (ref.)
Independent	280 (7.3)	42 (9.4)	0.77 (0.54-1.11)	0.88 (0.59-
Unemployed	109 (2.8)	22 (4.9)	0.68 (0.43-1.13)	0.84 (0.48-
Retired	963 (25.2)	50 (11.2)	1.57 (1.07-2.33)	2.02 (1.27-
Other inactive	347 (9.1)	46 (10.3)	1.28 (0.91-1.83)	1.28 (0.84-
Household composition				
Alone	570 (14.9)	58 (13.0)	1.00 (ref.)	1.00 (ref.)
Single parent with children	228 (6.0)	35 (7.9)	0.75 (0.48-1.19)	0.78 (0.46-
With partner and children	1607	227 (51.0)	0.85 (0.62-1.15)	0.86 (0.59-
With others but no children	1424	125 (28.1)	1.21 (0.86-1.68)	1.28 (0.86-
Chronic disease				
No	2784	369 (82.9)	1.00 (ref.)	1.00 (ref.)
Yes	1046	76 (17.1)	1.55 (1.20-2.02)	1.88 (1.39-
Smoking status				
Never smoker	2042	271 (60.9)	1.00 (ref.)	1.00 (ref.)
Former smoker	1208	113 (25.4)	1.22 (0.96-1.54)	1.27 (0.97-
Current smoker	579 (15.1)	61 (13.7)	1.29 (0.97-1.75)	1.50 (1.07-

Abbreviations: OR = odds ratio, CI = confidence interval, NA = not available, Ref = reference. Analytical sample in age- and sex-adjusted estimates were as follows: age (N=4261), sex (N=4261), education (N=4248), household income (N=3472), employment status (N=4260), household composition (N=4260), chronic disease (N=4261), smoking status (N=4260). The analytical sample in the complete case analysis of multivariable-adjusted estimates was N = 3464.

[†]Excluding participants who answered 'don't know'

^{**}Adjusted for sex, age, education, and income

¹ "Other" sex, "Other" education and "non-available" (NA) data in each category were excluded from logistic regression due to very low numbers; NAs with low counts were also excluded from the table for simplicity of presentation.

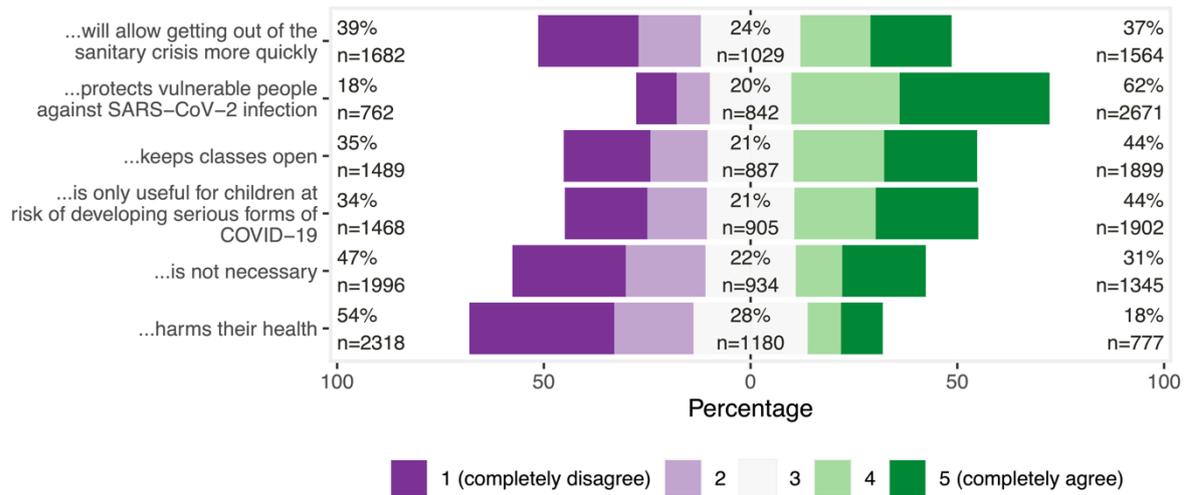
² Income category was calculated based on living conditions (alone, with partner, with or without children, with other adults) and reported household income.

Supplementary table 7. Parental intention to vaccinate their children and children's vaccination status

	Participants according to age of their children, n (%)		
	5-11 years	12-15 years	16-17 years
Has child been vaccinated against COVID-19?			
Yes, already received booster dose	0 (0)	32 (5.0)	95 (24.6)
Yes, already received 1-2 doses	75 (9.1)	362 (56.0)	230 (59.4)
Not yet, but I intend to get them vaccinated	101 (12.2)	14 (2.2)	1 (0.3)
Not yet, but already scheduled vaccine appointment	0 (0)	3 (0.5)	0 (0)
I still do not know if I would like to get them vaccinated	174 (20.9)	45 (7.0)	10 (2.6)
No, I do not intend to get them vaccinated	495 (59.6)	200 (31.0)	52 (13.4)

Note: parents with more than one child in an age group could respond more than once to this question, but the parent is only counted once in the denominator (5-11 = 831, 12-15=645, 16-17=387), so column percentages sum to more than 100.

The vaccination of children and adolescents...



Supplementary figure 1. Opinion on vaccination of children and adolescents. On a 5-point scale, participants were asked their opinion about each statement. Percentages on the left give total completely or somewhat disagreeing with the statement (i.e. chose 1 or 2), percentages in the middle are those without an opinion in either direction (chose 3), percentages on the right are the total in partial or complete agreement with the statement (i.e. chose 4 or 5). This question was asked to all participants (n=4275).