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Original article

## Parents' Willingness to Vaccinate Their Children With COVID-19 Vaccine: Results of a Survey in Italy

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Article history: Received July 12, 2021; Accepted January 4, 2022

Keywords: Adolescents; Attitudes; Children; COVID-19 vaccination; Italy; Parents; Survey; Willingness



### ABSTRACT

**Purpose:** This cross-sectional study was conducted to assess the parents' willingness to vaccinate their children with the COVID-19 vaccine and related determinants with specific attention to willingness for adolescents as compared to younger children.

**Methods:** Data were collected through a confidential online questionnaire.

**Results:** A total of 607 parents agreed to participate. More than two-thirds of the parents had good knowledge about the modes of transmission of COVID-19, knew that subjects of any age may be susceptible to SARS-CoV-2 infection, and 85.5% correctly indicated the main behavioral preventive measures against COVID-19. With regard to attitudes, 78.7% agreed that COVID-19 is a serious disease, whereas only 42.3% agreed that it is preventable. Overall, 68.5% were willing to vaccinate their children with the COVID-19 vaccine, specifically 74.5% of parents of adolescents and 65.5% of those of younger children, and the results of the multivariate analysis showed that parents of adolescents aged 12–15 years or 16–18 years compared to those of children aged 11 years or less, those who had more than two children, those who reported that their children had been visited by the primary care pediatrician/physician in the previous 12 months, those who agreed that COVID-19 is a serious disease, considered very useful the COVID-19 vaccine, had been vaccinated against influenza in the previous season, and had received at least one shot of COVID-19 vaccine were more likely to be willing to vaccinate their children.

**Conclusion:** In conclusion, a relevant proportion of parents are willing to vaccinate their children, with the parents of adolescents showing a higher willingness compared to those of younger children. However, there is still room for reducing hesitancy and refusal of the COVID-19 vaccine in this strategic population group by promoting communication to mitigate concerns toward the COVID-19 vaccine.

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### IMPLICATIONS AND CONTRIBUTION

Providing correct information to parents about the usefulness COVID-19 vaccine may be effective for reducing hesitancy in this strategic population group.

**Conflicts of interest:** The authors have no conflicts of interest to disclose.

Authors' contributions: Conceptualization, G.D.G., M.P.; methodology, G.D.G., M.P.; data acquisition: A.S.V.; formal analysis, G.D.G., C.P.P., A.S.V., F.N., and M.P.; data curation, G.D.G., A.S.V., F.N., C.P.P.; writing-original draft preparation, G.D.G., F.N., M.P.; writing-review and editing, M.P.; supervision, M.P. All authors have read and agreed to the published version of the manuscript.

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As of December 2020, the first COVID-19 vaccine has been approved [1,2], prompting the design and implementation of mass vaccination strategies worldwide. As expected, due to the shortage of vaccines in the first months of the year, strategies have first been oriented to the protection of groups at the highest risk of COVID-19 exposure, transmission, and severe clinical course, such as healthcare workers (HCWs), the institutionalized

and community elderly, and subjects with underlying medical conditions that were also the categories for which the vaccines had been licensed. Since children and adolescents are mostly asymptomatic or show a mild disease, their vaccination was not a priority in the context of poor vaccine supply, and at the time of the survey, only one vaccine was approved for  $\geq 16$ -year-old subjects [3]. However, children and adolescents experience the same rates of infection of other population age categories, making them a potential source of infection for more at-risk subjects in their families, in schools, and the community; and several studies have shown that COVID-19, particularly when the delta variant is involved, may be a serious disease even in children and adolescents, with severe complications and need of hospitalizations [4,5].

Exploring the acceptability of vaccinations is crucial before planning vaccination programs, and indeed willingness to receive COVID-19 vaccination has been initially investigated for those groups of the population that for various reasons had been prioritized for the delivery of COVID-19 vaccines, such as HCWs [6,7], the general public [8,9], the elderly [10], prisoners [11], [12], and subjects with underlying medical conditions [10,13].

Children and adolescents were not a priority group for vaccination, and COVID-19 vaccines have been more recently licensed for these subgroups; compared to other age categories, specifically, for subjects aged 12–15, a COVID-19 vaccine had been licensed in May 2021 [14–16]. Therefore, at the time of the survey, parents' willingness to vaccinate their children had not yet been extensively investigated [17–20]. Eventual hesitancy or refusal of parents would be a substantial barrier to the success of the mass vaccination campaign, considering that in Italy, vaccination coverage in children and adolescents for measles (93.8%/89.8%), mumps (93.7%/89.1%), and rubella (93.7%/89.2%) has increased [21], while other recommended vaccinations are still inadequate, ranging from 9.1% for rotavirus to 73.1% for meningitis in children, and from 10.5% for influenza to 58.6% for meningitis in adolescents [21]. Therefore, prompt assessment of factors that may affect vaccine acceptability of parents plays a key role in the development of approaches to increase the acceptance of the COVID-19 vaccine. These factors have been extensively studied for other recommended vaccinations, highlighting substantial and worrying parents' vaccine hesitancy [22–24], and include facilitators, such as information source and trust in HCWs, [23,25] and barriers, such as low education level and economic status, age, and concerns about vaccines' efficacy and safety [25,26], as well as emotional factors, promoted by disinformation about the efficacy and safety of vaccinations [27,28].

Therefore, this study was conducted to assess the willingness to vaccinate their children with the COVID-19 vaccine and the key predictors of this intention among parents in Italy, with specific attention to willingness for adolescents as compared to younger children.

## Methods

### Study design and setting

This cross-sectional study was conducted in Italy from April 18 to May 18, 2021, among parents of children and adolescents aged between 1 and 18 years, when COVID-19 vaccination was not yet available for children and adolescents.

A two-stage cluster sampling was used to recruit the parents; in the first stage, 12 schools were randomly selected out of the list of 75 primary and secondary, and of 25 high public schools in the metropolitan area of Naples, in the South of Italy. In the second stage, the parents were recruited from each selected school through a simple random sampling technique.

The sample size was determined before study initiation. It was estimated that approximately 65% of the parents would be willing to vaccinate their children [17–20]; thus, under the assumption of a 60% response rate [29,30], a margin of 5% error, and a 95% confidence level, the “minimum” total sample size was estimated at 583 parents.

### Data collection

Before the study initiation, the directors of each selected school were contacted by e-mail through an invitation letter to present the project and then by telephone to obtain their approval and cooperation. Subsequently, selected parents received an e-mail from the school director containing a link through which they had access to the confidential online questionnaire. The questionnaires, distributed through the Google Drive platform (Google Inc. Mountain View, CA, USA), contained a cover letter that explained the purposes of the study and the methods of data collection, assured that the survey was voluntary and that all data would be collected and analyzed confidentially, and specified that the sending back of the completed questionnaire would be considered an implicit consent to participation. The completed questionnaires were automatically uploaded to the Google Drive platform and transferred to a database to proceed with the statistical analysis. No monetary compensation or gift was given to the respondents, and three reminder requests were sent to nonresponders in order to improve the response rate.

### Survey questionnaire

The questionnaire was prepared ad hoc, adapting survey instruments used in previously published investigations performed by our research group on the willingness of parents to vaccinate their children and after a thorough review of the literature [22–24]. The structured questionnaire collected information on the following topics: (1) sociodemographics and health history of the parent completing the questionnaire, including age, gender, and nationality, type of parent (mother, father or tutor), marital status, number of children, own and partner's education level and working activity, history of COVID-19 and related symptoms, history of COVID-19 cases in friends, relatives, etc., history of influenza and COVID-19 vaccination and of any side effect; (2) characteristics of the child, including age, underlying medical conditions and related therapy, visit(s) to the primary care pediatrician/physician in the previous 12 months, and history of childhood mandatory and recommended vaccinations, including influenza; (3) knowledge about COVID-19 (modes of transmission and measures of prevention, including vaccination); (4) attitudes about COVID-19, the perceived benefits and risks of related vaccinations and willingness or unwillingness to vaccinate their own child with COVID-19 vaccine and related reasons; (5) sources of information about vaccines, including need for other information about anti-COVID-19 vaccination.

**Table 1**  
Selected characteristics of participants and related willingness to vaccinate their children with the COVID-19 vaccine

Characteristics	Total n = 607		Willingness to vaccinate their children with the COVID-19 vaccine n = 416 (68.5%)	
	N	%	N	%
<b>Sociodemographic and anamnestic characteristics</b>				
Gender				
Female	500	82.4	333	66.6
Male	107	17.6	83	77.6
			$\chi^2 = 4.919; p = .027$	
Age, years <sup>a,b</sup>	42.3 ± 6.5 <sup>a</sup>		42.5 ± 6.4 <sup>a</sup>	
Parents' willing to vaccinate			42 ± 6.5 <sup>a</sup>	
Parents' unwilling to vaccinate			$t = -0.83; p = .404$	
Nationality				
Italian	600	98.8	413	68.8
Foreigners	7	1.2	3	42.9
			Fisher's exact p = .214	
Marital status <sup>b</sup>				
Married/cohabiting	555	91.6	383	69
Unmarried/widowed/separated/divorced	51	8.4	33	64.7
			$\chi^2 = 0.402; p = .526$	
At least one HCW parent				
No	542	89.3	354	67.2
Yes	65	10.7	52	80
			$\chi^2 = 4.44; p = .035$	
At least one parent with college degree				
No	229	37.7	147	64.2
Yes	378	62.3	269	71.2
			$\chi^2 = 3.21; p = .073$	
Having contracted COVID-19				
No	519	85.5	359	69.2
Yes	88	14.5	57	64.8
			$\chi^2 = 0.675; p = .411$	
At least one COVID-19 symptom <sup>b,c</sup>				
No	16	18.8	8	50
Yes	69	81.2	47	68.1
			$\chi^2 = 1.866; p = .172$	
At least one relative who contracted COVID-19				
No	161	26.5	189	66.1
Yes	446	73.5	227	70.7
			$\chi^2 = 1.505; p = .22$	
Having received influenza vaccine in the last season				
No	431	71	274	63.6
Yes	176	29	142	80.7
			$\chi^2 = 16.9; p < .001$	
Having received at least one shot of COVID-19 vaccine				
No	390	64.2	246	63.1
Yes	217	35.8	170	78.3
			$\chi^2 = 15.06; p < .001$	
Having experienced side effects after receiving COVID-19 vaccine <sup>d</sup>				
No	46	21.2	288	66.1
Yes	171	78.8	128	74.9
			$\chi^2 = 4.41; p = .036$	
Number of children				
1	185	30.5	124	67
2	334	55	223	66.8
>2	88	14.5	69	78.4
			$\chi^2 = 4.66; p = .097$	
Children's age, years <sup>a</sup>	9.5 ± 4.3 <sup>a</sup>			
≤11	403	66.4	264	65.5
12–15	139	29.9	99	71.2
16–18	65	10.7	53	81.5
			$\chi^2 = 7.27; p = .026$	
Children with at least one underlying medical condition				
No	542	89.3	371	68.5
Yes	65	10.7	45	69.2
			$\chi^2 = 0.02; p = .898$	
Children having had at least one visit by the primary care pediatrician/physician in the previous 12 months				
No	172	28.3	106	61.6
Yes	435	71.7	310	71.3
			$\chi^2 = 5.31; p = .021$	
Children vaccinated against influenza				

**Table 1**  
Continued

Characteristics	Total n = 607		Willingness to vaccinate their children with the COVID-19 vaccine n = 416 (68.5%)	
	N	%	N	%
Never	416	68.5	269	64.7
At least once	191	31.5	147	77
			$\chi^2 = 9.2; p = .002$	
Knowledge about COVID-19 and related vaccination				
Knowledge of main COVID-19 modes of transmission				
No	128	21.1	91	71.1
Yes	479	78.9	325	67.9
			$\chi^2 = 0.49; p = .483$	
Knowledge that subjects of any age may be susceptible to SARS-CoV-2 infection				
No	47	7.7	28	59.6
Yes	560	92.3	388	69.3
			$\chi^2 = 1.89; p = .168$	
Knowledge of main behavioral COVID-19 preventive measures				
No	88	14.5	64	72.7
Yes	519	85.5	352	67.8
			$\chi^2 = 0.84; p = .36$	
Knowledge that COVID-19 vaccine is available in Italy				
No	30	4.9	17	56.7
Yes	577	95.1	399	69.2
			$\chi^2 = 2.06; p = .151$	
Having acquired information about COVID-19 vaccine availability by physicians <sup>b,e</sup>				
No	354	62	244	68.9
Yes	217	38	151	69.6
			$\chi^2 = 0.03; p = .869$	
Attitudes about COVID-19 and related vaccination				
Belief that COVID-19 is a serious disease				
Uncertain \ Disagree	129	21.3	65	50.4
Agree	478	78.7	351	73.4
			$\chi^2 = 25.01; p = <.001$	
Belief that COVID-19 is a preventable disease				
Uncertain \ Disagree	350	57.7	233	66.6
Agree	257	42.3	183	71.2
			$\chi^2 = 1.47; p = .224$	
Concern that their child may contract COVID-19 (1–10 points)				
No (<10)	377	62.1	252	66.8
Yes (10)	230	37.9	164	71.3
			$\chi^2 = 1.318; p = .251$	
Concern that their children could transmit the infection to family members, cohabitants and acquaintances (1–10 points)				
No (<10)	308	53.6	200	64.9
Yes (10)	267	46.4	189	70.8
			$\chi^2 = 2.238; p = .135$	
Belief that COVID-19 vaccine is useful (1–10 points)				
No (<8)	161	26.5	59	36.7
Yes (8–10)	446	73.5	357	80
			$\chi^2 = 103.32; p = <.001$	
Sources of information about COVID-19				
Sources of information about COVID-19 vaccine <sup>b</sup>				
Physicians	368	60.7	255	69.3
Other	238	39.3	161	67.7
			$\chi^2 = 0.182; p = .67$	
Need to receive additional information about COVID-19 vaccination				
No	242	39.9	164	67.8
Yes	365	60.1	252	69
			$\chi^2 = 0.109; p = .741$	
Need to receive additional information about COVID-19 vaccination from physicians <sup>b</sup>				
No	344	57.7	229	66.6
Yes	252	42.3	183	72.6
			$\chi^2 = 2.494; p = .114$	

<sup>a</sup> Mean ± Standard deviation.<sup>b</sup> Number of each item may not add up to total number of study population due to missing values.<sup>c</sup> Among those who had contracted COVID-19.<sup>d</sup> Among those who had received at least one shot of COVID-19 vaccine.<sup>e</sup> Among those who knew that COVID-19 vaccine is available in Italy.

Knowledge questions were close-ended with “yes” or “no” or multiple choices response format. Statements on perception of severity and opportunity for prevention of COVID-19 were on a three-point Likert-type scale (1 = agree, 2 = uncertain, 3 = disagree). Parents’ concern about the risk of their child/children contracting COVID-19 and about the transmission of the infection to family members, cohabitants, and acquaintances were measured on a 10-point Likert scale with a score ranging from 1 (not at all concerned) to 10 (very concerned). Parents’ attitudes regarding the usefulness of the COVID-19 vaccine were measured on a 10-point Likert scale with a score ranging from 1 (useless) to 10 (very useful), and parents’ willingness or unwillingness to vaccinate their own child with a “no” or “yes” format. The parents were also asked to indicate the reasons for their willingness or unwillingness to administer the COVID-19 vaccine to their child with close-ended, not mutually exclusive multiple choices responses. Questions on sources of information were close-ended with multiple choices or “no” or “yes” responses.

Before starting the survey, a pilot study on 50 parents was carried out to ensure correct interpretation, feasibility and reliability of the questions.

The study was approved by the Ethics Committee of the University of Campania “Luigi Vanvitelli.”

### Statistical analysis

The results of the descriptive analysis are reported as frequencies, percentages, means, and standard deviations (SD). Bivariate appropriate tests (t-tests, chi-square tests, and Fisher exact test) have been used to assess the associations between each of the independent characteristics and parents’ willingness to vaccinate their children with the COVID-19 vaccine. After performing the exploratory bivariate analyses, a multivariate stepwise logistic regression model was performed to assess the independent predictors of the explored parents’ willingness according to the Hosmer and Lemeshow model building strategy. Specifically, only those variables found to be associated at the  $p$  value  $\leq .25$  level were introduced into the model [31].

Backward stepwise procedures were applied so that the final model only included characteristics providing a significant explanation of outcomes, in which the criterion for entering and being retained in the model was a  $p$  value respectively of .2 and .4 [31]. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were presented, and the two-sided statistical tests were set at  $p \leq .05$  statistical significance. A detailed description of the independent variables included in the model is reported as Appendix A1. Analyses were performed using Stata 15 software [32].

## Results

### Sociodemographic and anamnestic characteristics of parents and children

Of the 1,000 parents invited, 607 agreed to participate in the study for a response rate of 60.7% and the main parents’ and children’s characteristics are described in Table 1. A large majority of responding parents (82.4%) were females, the average age was 42.3 years (range:22–63), most were married/cohabiting (91.6%), in more than half of the families there was at least one parent with a college degree (62.3%), and in 10.7% at least one HCW parent, two-thirds (66.4%) were parents of children

aged  $\leq 11$  years, and more than two-thirds (69.5%) had more than one child.

Parents reporting to have contracted COVID-19 were 14.5%, and 81.2% of them had had at least one COVID-19 symptom. One-third of parents (35.8%) had received at least one shot of the COVID-19 vaccine, 78.8% of them had experienced side effects after receiving the vaccine, and 29% of participants had received influenza vaccine during the previous influenza season.

Regarding children’s characteristics, one in ten (10.7%) had at least one underlying medical condition, and 6.6% took medications. More than two-thirds of parents (71.7%) reported that their children had been visited by the primary care pediatrician/physician in the previous 12 months, and 64.5% of them had had more than one visit, 31.5% had been vaccinated at least once against influenza, 7.6% had not received the childhood vaccinations (diphtheria, hepatitis B, polio, tetanus, *Haemophilus influenzae* type b, pertussis), 6.7% and 14% had not received measles/mumps/rubella and varicella vaccine, respectively, and only 34.3% of the eligible children had been vaccinated against Human Papillomavirus.

### Parents’ knowledge regarding COVID-19 and related vaccination

More than two-thirds of the parents (78.9%) correctly reported the modes of transmission of COVID-19 (through respiratory droplets and by touching a surface contaminated by SARS-CoV-2), whereas one in four (24.9%) indicated that COVID-19 is transmitted only through respiratory droplets. Almost all participants (92.3%) knew that subjects of any age may be susceptible to SARS-CoV-2 infection and 85.5% correctly indicated the main behavioral preventive measures against COVID-19 (wearing a mask, staying at least 1 meter apart from other people, avoiding crowded places, and frequently washing one’s hands). Moreover, only 54% knew that the vaccine is an effective preventive measure, and almost all (95.1%) knew that the COVID-19 vaccine is available in Italy. Among those who have this knowledge, 38% indicated that they had heard of the COVID-19 vaccine from physicians.

### Parents’ attitudes regarding COVID-19 and related vaccination

When parents were asked about their attitudes, 78.7% agreed that COVID-19 is a serious disease, whereas only 42.3% agreed that it is preventable. One third of participants (37.9%) were very concerned about their children’s risk of contracting COVID-19 with an overall mean value of eight out of a maximum score of 10, and almost half (46.4%) that their children could transmit the infection to family members, cohabitants, or acquaintances with an overall mean value of 8.3. Moreover, almost three-quarters of parents considered the COVID-19 vaccine very useful (73.5%) with an overall mean value of 8.3, and 68.5% were willing to vaccinate their children against COVID-19, specifically 74.5% of parents of adolescents and 65.5% of those of younger children.

The results of the univariate analysis are reported in Table 1 and were partially confirmed by those of the stepwise logistic regression analysis performed to estimate predictors of the willingness to vaccinate, which showed that parents of adolescents aged 12–15 years (OR = 1.73; 95% CI 1.03–2.91), or 16–18 years (OR = 2.92; 95% CI 1.32–6.44) compared to those of children aged 11 years or less, those who had more than two children (OR = 2.13; 95% CI 1.04–4.36), those who reported that their children had been visited by the primary care pediatrician/

**Table 2**

Multiple logistic regression analysis about willingness to vaccinate their children with the COVID-19 vaccine according to several explanatory variables

Variable: Willingness to vaccinate their children with COVID-19 vaccine	OR	95% CI	p
Log likelihood = -291.38, $\chi^2 = 141.12$ (11 df), $p < .0001$ , No. of obs = 575			
Children's age, years			
≤11	1.00 <sup>a</sup>		
12–15	1.73	1.03–2.91	.038
16–18	2.92	1.32–6.44	.008
Number of children			
1	1.00 <sup>a</sup>		
2	1.22	.77–1.94	.398
>2	2.13	1.04–4.36	.039
Having received at least one shot of COVID-19 vaccine			
No	1.00 <sup>a</sup>		
Yes	5.12	1.68–15.61	.004
Having received influenza vaccine in the last season			
No	1.00 <sup>a</sup>		
Yes	1.73	1.06–2.83	.028
Belief that COVID-19 vaccine is useful (1–10 points)			
No (<8)	1.00 <sup>a</sup>		
Yes (8–10)	5.98	3.85–9.28	<.001
Belief that COVID-19 is a serious disease			
Uncertain \ Disagree	1.00 <sup>a</sup>		
Agree	1.7	1.05–2.75	.029
Children had at least one visit by the primary care pediatrician/physician in the previous 12 months			
No	1.00 <sup>a</sup>		
Yes	1.86	1.17–2.93	.008
Having experienced side effects of COVID-19 vaccine			
No	1.00 <sup>a</sup>		
Yes	0.32	.1–1.02	.054
Concern that their child could transmit the infection to family members, cohabitants, or acquaintances (1–10 points)			
No (<10)	1.00 <sup>a</sup>		
Yes (10)	1.37	.91–2.07	.131
Backward elimination			
Gender			
At least one HCW parent			
At least one parent with college degree			
At least one relative who contracted COVID-19			
Children vaccinated against influenza			
Belief that COVID-19 is a serious disease			
Concern that their child may contract COVID-19			

<sup>a</sup> Reference category.

physician in the previous 12 months (OR = 1.85; 95% CI 1.17–2.93), those who agreed that COVID-19 is a serious disease (OR = 1.7; 95% CI 1.05–2.75), considered the COVID-19 vaccine very useful (OR = 5.98; 95% CI 3.85–9.28), had been vaccinated against influenza in the previous season (OR = 1.73; 95% CI 1.06–2.83), and had received at least one shot of COVID-19 vaccine (OR = 5.12; 95% CI 1.68–15.61) were more likely to be willing to vaccinate their children (Table 2).

The most frequently reported reasons by parents of adolescents and younger children to vaccinate against COVID-19 were being favorable to vaccinations (59.2% and 65.4%, respectively), willing to protect older or with underlying medical conditions family members/cohabitants (43.4% and 38.8%, respectively), trust in the effectiveness of the COVID-19 vaccine (40.8% and 35%, respectively), and concern about the risk for their child to contract COVID-19 (29.6% and 33.8%, respectively). Reasons for refusing to vaccinate their children against COVID-19 included concern about the safety (69.4% and 61.4%, respectively) and the effectiveness (10.2% and 17.4%, respectively) of COVID-19 vaccine, and lack of COVID-19 vaccine recommendation by the primary care pediatrician/physician (14.3% and 19.7%, respectively).

### Sources of information

All parents reported to have received information about COVID-19 vaccination, and physicians were the main source of information (60.7%). However, almost two-thirds of the parents (60.1%) reported that they felt the need to receive additional information about COVID-19 vaccination, with 69% of them preferring to be informed by physicians.

### Discussion

There is no doubt that the development and uptake of vaccines are fundamental actions in the strategies aimed at tackling the COVID-19 pandemic. However, the availability of a vaccine, as well as its adequate production and distribution are not sufficient if vaccine acceptance and uptake in the target populations do not reach the specific threshold for the interruption of transmission. At the time of this survey, about 87% and 66% of subjects aged ≥80 years and between 70 and 79 years, respectively, had received at least one shot of COVID-19 vaccine, and more than 70% of those aged ≥80 years had completed the vaccination schedule. In this context, the inclusion of children and

adolescents in the COVID-19 vaccination strategy would be crucial to reduce the spread of the infection within the populations. Therefore, the results of this study would add knowledge on a key issue since it investigated the willingness of parents to vaccinate their children and adolescents and eventual factors that facilitate or represent obstacles to the adherence to the COVID-19 vaccination strategy in these subjects.

One of the main findings of this study is that more than two-thirds of parents (68.5%) reported their willingness to vaccinate their children against COVID-19 with a higher willingness in parents of adolescents (74.5%) compared to those of younger children (65.5%). The values found in this study are within the results of previous similar investigations in parents, reporting willingness ranging from 36.3% in Turkey [33] to 80% in New Zealand [20]. It should be acknowledged, however, that most of the studies have been conducted before COVID-19 vaccines became available [18,19,29,34], whereas in the few studies [33,35] conducted after the introduction of the vaccination the willingness in parents tended to be lower. This finding is concerning, suggesting that the information on possible side effects related to the vaccines may have reduced the willingness of parents to have their children undergo COVID-19 vaccination. This result has already been reported in a meta-analysis of studies involving 13 countries, that revealed a decline in the willingness to accept COVID-19 vaccination in adult subjects as the pandemic has progressed [36], probably as a consequence of exposure to misinformation about COVID-19 and concerns about the safety of the vaccine. Indeed, several investigations have also shown that information on vaccines provided by Internet and social media was associated to low MMR vaccination coverage in Italy [37] and to parents' vaccine hesitancy in Israel [38], whereas trust in physicians and scientists, and physicians as source of information have been repeatedly found to be determinants of high vaccine acceptance [23,25]. Remarkable differences in the willingness to vaccinate children and adolescents have been encountered across countries during similar periods and this was also the case of the mentioned meta-analysis in the adult population [36], suggesting that context specific factors play a major role in the attitudes toward COVID-19 vaccination, highlighting the need for tailored and setting specific interventions to promote public acceptance of the vaccination. Indeed, the role of context variables is considered crucial in the development of hesitancy toward vaccinations, as reported in one of the seminal publications investigating this issue [39]. Furthermore, it should be noted that knowledge on modes of transmission of COVID-19 of the parents was very spread, while only half of the sample knew that the vaccine is an effective preventive measure. However, it should be acknowledged that at the beginning of the COVID-19 vaccination mass campaign the population was not yet aware of its effectiveness and impact.

The willingness reported in this study is, on average lower than that found in the adult population [9]. This is expected since parents are very concerned by safety issues related to the vaccination for their children, and indeed in this study, the most frequently reported reason for intending to refuse the COVID-19 vaccination was concern about the safety of the available vaccines. This is an interesting result since similar studies have reported lower rates of COVID-19 vaccine safety concerns [18,19], but they were conducted before the introduction of the COVID-19 vaccine in adults when no reports of side effects were known [18], and most concerns were addressed to the extremely rapid authorization process of the vaccine [34].

Several studies conducted about vaccination acceptance showed that safety and efficacy were the main parents' concerns for all vaccinations [40,41].

Understanding determinants influencing parents in the decision process to vaccinate their children is critical to assure the success of the vaccination campaign, and the findings of this study have revealed that predictors of parents' willingness were related to children and parenthood characteristics, attitudes toward COVID-19 vaccination, the practice of previous vaccinations, and contacts with physicians/pediatricians. In particular, it should be noted that the strongest predictor of the parents' willingness was the belief that the COVID-19 vaccine is very useful, and this attitude has been found to be a determinant of acceptance also in previous investigations [42]. Furthermore, the finding that parents of adolescents are more willing to vaccinate has been reported [35], and it has been linked to considering younger children more prone to the side effects of the vaccination. Moreover, being concerned about the seriousness of COVID-19, as well as being confident on the effectiveness of the COVID-19 vaccine, were predictors of parents' willingness also in the study by Skjelfe et al. [34], whereas the previous experience of influenza and COVID-19 vaccination were found to be determinants of parents' intention to vaccinate in the survey by Goldman et al. [18]. Finally, since having their child being visited by a primary care pediatrician/physician can be considered a proxy for having had contact with a physician, this finding highlights the relevance of information received by HCW on vaccinations, which has been reported as a predictor of willingness to vaccinate their children with COVID-19 vaccine in several studies conducted on parents [35], as well as in other investigations on recommended childhood vaccinations [22,43,44]. The role of these determinants is confirmed by reasons reported by parents for intention, as well as for refusing to vaccinate their children. Indeed, an overall favorable attitude toward vaccinations was the most frequently reported reason for willingness to vaccinate, along with specific trust in the efficacy of COVID-19 vaccine, belief in the seriousness of risk for their children to contract COVID-19, and intent to protect fragile family members, with no significant differences between parents of adolescents and those of younger children.

All of these findings, coupled with the reported motivations for not willing to vaccinate their children, including lack of recommendations by primary care pediatrician/physician, demonstrate the attitudinal nature of both promoting factors and barriers to willingness to vaccinate children against COVID-19, also highlighting the crucial role of HCWs as a trusted source in the decision process to accept to undergo vaccinations. These results add knowledge on the targets of interventions designed to improve acceptance of COVID-19 vaccination in children. Transparent and clear communication on benefits and risks of COVID-19 vaccines, preferably provided by HCWs, should be the core of interventions, which should be addressed to predisposing factors, mainly focused to the mitigation of concerns and the development of positive attitudes toward the COVID-19 vaccination. This was not foregone, since it has been demonstrated that interventions to promote adherence to vaccination in other contexts and populations would have benefited from the involvement of enabling factors, rather than predisposing factors, such as the case of HCWs' willingness to undertake influenza vaccination in the context of COVID-19 pandemic [45] or all other HCWs recommended vaccinations [46].



## Limitations

There are some potential limitations in the study that need to be dealt with before interpreting the results. First, the analyses were based on cross-sectional data, and therefore, the nature of the associations limited us from drawing definitive causal conclusions about the observed relationships between determinants and willingness. Second, in this study, parents were asked to respond to a hypothetical situation since, at the time of the survey, children and adolescents were not yet involved in the vaccination campaign, and the indication that they would accept a COVID-19 vaccine might not correspond to true uptake rates; moreover, vaccine acceptance levels might change over the course of time, especially as vaccine trials and vaccine education campaigns evolve. Third, as with many surveys, when one parent is involved, there was an overestimation of the responses from mothers, which were the great majority of the recruited sample. Although it was not the case of this study, previous investigations have revealed that mothers tend to be significantly less likely to be willing to vaccinate their children against COVID-19 [21]; therefore, our findings may have underestimated the overall intention of parents; however, since in our context mothers are more frequently responsible of their children's health as compared to fathers, we believe that our estimate is adequate to measure overall willingness in our area. Indeed, this study was carried out in Southern Italy, and our sample might not be completely representative of the Italian parents, but at least of those in Southern Italy. Fourth, it was not possible to collect information on parents who refused to participate in the study, which may have different characteristics than the study participants. However, our response rate was sufficiently high to suggest that no substantial differences in the estimates would have been introduced by the results on non-responders. Fifth, only parents who had an e-mail account were included, but this bias was negligible since, in Italy, all communications from schools to parents are made through e-mail, and from the beginning of COVID-19 related school distance learning, at least one parent was required to have an e-mail account. Finally, parents expressed their attitude during a period of lay-off school, and their willingness to vaccinate their own children against COVID-19 might change when regular activities are re-established.

In conclusion, a relevant proportion of parents are willing to vaccinate with a higher willingness in parents of adolescents compared to those of younger children. However, there is still room for reducing hesitancy and refusal of the COVID-19 vaccine in this strategic population group. The findings of this study suggest that, in our context, interventions should be targeted to remove attitudinal barriers by promoting communication aimed at the mitigation of concerns and the promotion of positive attitudes toward COVID-19 vaccine in children and adolescents.

## Acknowledgments

We would like to thank the participants who voluntarily shared their perspectives with us.

## Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jadohealth.2022.01.003>.

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