

Covid-19 vaccine hesitancy in a western Indian urban population: A parental survey

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Abstract

Introduction: Western experience shows that with subsequent waves of corona virus disease-2019 (Covid-19), children were affected more and required hospitalization. Universal Covid-19 vaccination among children is difficult to advocate given the low severity of Covid-19 in this age group.

Objectives: This study assesses vaccine hesitancy (VH) among an urban-majority survey-population in Ahmedabad, Gujarat and the factors bearing on it.

Method: A 26-point questionnaire was circulated among parents with children up to 18 years of age online as well as offline, assessing age, education, urban vs. rural dwelling, previous Covid-19 and Covid-19 vaccination status and the existing information regarding Covid-19 in children in previous and impending waves. Intention of the respondents to vaccinate their children immediately, wait-and-watch or not vaccinate at all and reasons leading to it were explored. The primary outcome was VH (wait-and-watch or not-opting-to-vaccinate). Intention to vaccinate immediately was taken as reference. We used multinomial logistic regression to assess the association of outcome with age, gender, education, previous Covid-19 and vaccination status. Analysis was done using STATA-16 software.

Results: Of 1102 respondents, VH was reported by 37.6%. Respondents who were older, females, unvaccinated, believed Covid-19 would not be more severe among children and those having safety concerns with vaccines were more likely to report VH. Vaccine related information obtained from healthcare workers was associated with the least VH. Rapid development and approval of vaccines did not affect VH.

Conclusions: Age, gender, Covid-19 vaccination status of parents and perception of severity of Covid-19 among children were major determinants of VH in our study. Source of vaccine-related (mis)information concerns related to short- and long-term safety of vaccines was significantly associated with VH.

(Key words: Covid-19, Child, Infection, Pandemic, Vaccination)

Introduction

Globally, as on 11 January 2022, there have been over 300 million confirmed cases of Covid-19, and over 5.4 million deaths, reported to WHO¹. Few therapeutic agents have been shown to be clearly beneficial². India has administered 1.5 billion doses of Covid-19 vaccines, with 46% of the population being fully vaccinated with 2 doses^{3,4}. Success of vaccines in preventing mortality has been impressive, with at least 98% protection even after a single dose⁵. A Subject Expert Committee has recommended the Drugs Controller-General of India to grant emergency use authorization (EUA) for BBV152/COVAXINTM (Bharat Biotech, India) and ZyCov-DTM (Zydus-Cadilla, India) for use among children. In India, vaccination of children aged 15 to 18 years has been initiated, starting 3rd January, 2022.

Vaccination in children is a complex issue⁷. Mortality in children is relatively rare⁸⁻¹⁰. In a large survey by the US-based Institute for Policy Research, parents had significant hesitancy to vaccinate their children, especially younger mothers from lower educational background or lower socio-economic strata¹¹. However, it must be remembered that children aged 10-18 years are equally affected by Covid-19 as per sero-survey reports¹². Covid-19 related Multisystem

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Inflammatory Syndrome in Children (MISC) is associated with high morbidity¹³. Further, lack of vaccination in children may result in absence of herd immunity allowing breakthrough clusters of infection and further waves of Covid-19.

Method

Questionnaire was formulated with variables adapted from Centre for Disease Control (CDC) format of assessing survey-based questions regarding Covid-19 vaccination¹⁴. Parents with children aged 10-18 years were requested to fill up a survey questionnaire. Respondents were recruited from medical college outpatient and vaccination centres, private clinics, housing societies, and friend circles of the authors. The ease of understanding and the time needed to fill the form were assessed using dummy participants and the form was appropriately modified. The form consisted of basic demographic data of the parents, their educational status, their own vaccination status and experience with Covid-19 vaccination. It also explored their knowledge about Covid-19 vaccination among children, their ideas about the “third wave”, their attitude towards offline schooling and their children playing with other kids. It also examined their attitude towards the Covid-19 vaccine developments, their concerns and overall attitude towards vaccination of their children.

Ethical issues: Approval was obtained from the Institutional Ethics Committee of Dr. M K Shah Medical College and Research Centre, Ahmedabad, India, on 28th September, 2021 before commencing study. Study was done on a hybrid offline and online platform where participation was strictly voluntary. All participant data will be kept confidential.

Statistical analysis:

Statistical tool used was STATA 16. Sampling method was random selection. To mitigate risk of unequal sample selection and resultant biased estimates, we calculated weight and finite population correction (FPC) at the time of survey planning. Population size of Ahmedabad for deducting FPC was 5,58,5528 as per official website. Survey was done without any cluster variable or stratification. Variance estimation of standard error was selected as the linearized method. Dependent variable was Covid-19 vaccine hesitancy (VH) which was the primary outcome. Dependent variable was graded as no, don't know, and yes response to an immediate vaccine acceptance. No missing data computation was applicable as the individual survey was complete, and no data were missing. As primary outcome of interest was a non-binary categorical value which is also nominal data, we used multinomial logistic regression to interrogate the association of

outcome with baseline characteristics. Independent variables assessed were age categories, gender, educational status, literacy level. No hesitancy was used as reference outcome. Convergence tolerances applied was 1e-5, 1e-6 and 1e-7 for Hessian-scaled gradient, Coefficient vector and log likelihood. The model voided the null hypothesis which was tested by Likelihood square test and MacFadden's Pseudo R² test. Results were described as relative risk ratio, standard error and 95% confidence interval. A two-tailed value <0.05 was considered statistically significant. We also performed a multinomial regression model with the above statistical method for association of outcomes to Covid-19 related knowledge and practices in the paediatric population. Response to Covid-19 vaccination acceptance was illustrated in bar graphs with their 95% confidence interval as error bars. Bar graphs were created in MS Excel sheet version 2019.

Results

A total of 1102 participants completed the form. Table 1 shows the demographic data, Covid-19 exposure and Covid-19 vaccination status of participants.

Table 1: Demographic details of survey respondents (n=1102)

Characteristic	Number
<i>Parental age (years) - Median (IQR)</i>	39 (34-42)
18-29	19
30-39	602
40-49	385
50-59	67
>59	29
<i>Children's age (years) - Median (IQR)</i>	12 (9-14)
<i>Urbanicity</i>	
Urban	1086
Rural	16
<i>Relationship status</i>	
Father	590
Mother	419
Guardian	93
<i>Educational qualification -highest</i>	
7 th grade school	07
Senior secondary school	19
Higher secondary school	11
Graduation /Bachelor's degree holder	382
Post-graduation/Master's degree	683
<i>Previous Covid-19 infection</i>	
Yes	107
No	995
<i>Covid-19 vaccination</i>	
0 doses	14
1 dose only	32
2 doses	1056

Figure 1 summarizes the patterns of vaccine hesitancy among survey respondents.

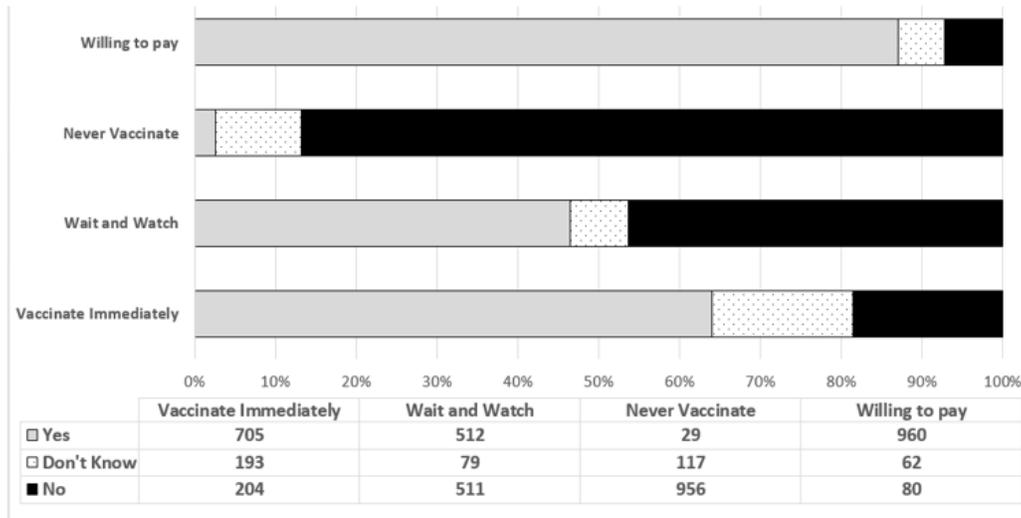


Figure 1: Patterns of Covid-19 vaccine hesitancy/acceptance

Although just 2.6% respondents were unwilling to vaccinate altogether, up to 18% respondents were unwilling to vaccinate their children as soon as vaccines were available, and another 17% wanted to take a 'wait-and-watch' stance. Thus, VH was documented in 37.6% respondents. About impending waves, 31.6% believed that children will be affected more frequently than previous waves. Another 47.3% felt unsure. Similarly, 12.9% and 21% were sure or were afraid (respectively) that cases in children would also be more severe. Just under 46% respondents relied upon news (television and print) for information on Covid-19 vaccination; 33.5% had consulted doctors and nurses for details

while social media was the major source of information for 18.5% respondents. On analysis of responses and comparison with baseline characteristics of survey population, respondents aged 18-29 were least likely to refuse vaccination (RR=2.09 ± 9.09, p<0.01). Similarly, females were significantly more likely to refuse vaccination (RR=1.69 ± 0.39, p=0.02). Those respondents who had themselves received Covid-19 vaccination were significantly more likely to accept vaccination for their children (RR =0.50 ± 0.13, p=0.01). Urban or rural living, educational qualification and previous Covid-19 infection in family were not significantly associated with VH (Table 2).

Table 2: Multinomial logistic regression analysis for vaccine acceptance as per baseline characteristics of survey participants

COVID-19 vaccine acceptance immediately	Linearized Coeff. ± SE	95% confidence interval		Linearized RRR ± SE	95% confidence interval		p-value
		Lower limit	Upper limit		Lower limit	Upper limit	
1. DEFINITE YES							
2. NEVER							
Parental age categories (years)							
18 – 29	-22.28 ± 0.43	-23.14	-21.44	2.09 ± 9.09	0.68	4.39	<0.01
30 – 39	0.008 ± 0.46	-0.89	0.90	1.0 ± 0.46	0.41	2.47	0.99
40 – 49	-0.22 ± 0.47	-1.14	0.70	0.80 ± 0.37	0.32	2.02	0.64
50 – 59	-0.45 ± 0.57	-1.57	0.67	0.63 ± 0.36	0.21	1.95	0.43
Sex	0.52 ± 0.22	0.08	0.98	1.69 ± 0.39	1.08	2.67	0.02
Relationship	-0.04 ± 0.19	-0.43	0.33	0.95 ± 0.18	0.65	1.40	0.80
Urbanicity	-0.78 ± 0.46	-1.69	0.12	0.45 ± 0.21	0.19	1.13	0.09
Educational qualification	0.21 ± 0.13	-0.03	0.46	1.2 ± 0.15	0.97	1.58	0.09
Previous Covid-19 infection in family	-0.12 ± 0.3	-0.71	0.46	0.88 ± 0.26	0.49	1.59	0.68
Covid-19 vaccination status	-0.67 ± 0.27	-1.20	-0.16	0.50 ± 0.13	0.30	0.86	0.01
3. DON'T KNOW							
Parental age categories (years)							
18 – 29	-1.37 ± 0.73	-2.80	0.05	0.25 ± 0.18	0.06	1.05	0.06
30 – 39	-1.68 ± 0.53	-2.72	-0.65	0.18 ± 0.09	0.07	0.52	<0.01
40 – 49	-2.5 ± 0.56	-3.59	-1.41	0.08 ± 0.04	0.03	0.24	<0.01
50 – 59	-1.91 ± 0.62	-3.13	-0.69	0.14 ± 0.09	0.04	0.50	<0.01
Sex	1.32 ± 0.26	0.82	1.83	3.75 ± 0.96	2.27	6.21	<0.01
Relationship	-1.42 ± 0.24	-1.89	-0.96	0.24 ± 0.57	0.15	0.38	<0.01
Urbanicity	1.23 ± 0.69	-0.12	2.59	3.42 ± 2.36	0.88	13.27	0.08
Educational qualification	0.29 ± 0.16	-0.02	0.61	1.34 ± 0.21	0.98	1.84	0.07
Previous Covid-19 infection in family	0.99 ± 0.29	-0.46	0.66	1.10 ± 0.31	0.63	1.94	0.73
Covid-19 vaccination status	-0.59 ± 0.3	-1.19	0.00	0.55 ± 0.16	0.31	1.00	0.05

Coeff: coefficient; SE: standard error; RRR: relative risk ratio; Relationship was scaled as 1, 2, and 3 for father, mother and guardian; Sex was scaled as 1, 2 and 3 for male, female and prefer not to say; Urbanicity was coded as 1 for urban and 2 for rural; Educational qualification was scaled from 1 to 5 from 7th, 10th, 12th, graduate and post-graduate. Previous Covid-19 history was coded as 1 for yes and 0 for no; vaccine status was scaled from 1 to 3 where 1 was unimmunized; 2 was partial vaccination and 3 was complete vaccination.

Respondents who believed that children will be more prone to Covid-19 infections and such infection can be severe and associated with mortality were significantly more likely to accept vaccination (RR 0.54 ± 0.08, p<0.01 for both attributes). Respondents whose source of information about vaccination were healthcare workers, were more like to accept vaccination (RR 0.57 ± 0.06, p<0.01). People having safety concerns with vaccine and

wary of long-term adverse effects were significantly less likely to accept vaccines (RR 1.67 ± 0.25 for short-term and RR 2.39 ± 0.42 for long-term risk, p<0.01 for both) (Table 3). Other concerns, like availability, hurried approval and commercial gain from vaccines were not associated with significant VH. Concerns of respondents regarding vaccine are depicted in Figure 2.

Table 3: Multinomial logistic regression analysis for vaccine acceptance and effect of various attitude and behavior related to Covid-19 infection and vaccine

COVID-19 vaccine acceptance immediately	Linearized Coeff. ± SE	95% confidence interval		Linearized RRR ± SE	95% confidence interval		p-value
		Lower limit	Upper limit		Lower limit	Upper limit	
1. DEFINITE YES							
2. NEVER							
<i>Knowledge about Covid-19 in the paediatric population</i>							
Children more prone to impending waves	-0.6 ± 0.14	-0.88	-0.32	0.54 ± 0.08	0.42	0.73	<0.01
Severity and mortality are higher in children	-0.6 ± 0.15	-0.9	-0.31	0.54 ± 0.08	0.41	0.73	<0.01
<i>Paediatric Covid-19 vaccine information</i>							
Information source	-0.56 ± 0.1	-0.76	-0.36	0.57 ± 0.06	0.47	0.70	<0.01
Accessibility issues	-0.22 ± 0.12	-0.46	0.01	0.80 ± 0.1	0.63	1.01	0.06
Safety concerns	0.52 ± 0.15	0.23	0.81	1.67 ± 0.25	1.25	2.24	<0.01
Unforeseen future effects	0.87 ± 0.18	0.53	1.22	2.39 ± 0.42	1.70	3.38	<0.01
Early approval	0.22 ± 0.11	-0.01	0.44	1.24 ± 0.14	0.99	1.56	0.06
Efficacy of vaccine	-0.12 ± 0.18	-0.46	0.23	0.89 ± 0.16	0.63	1.26	0.52
Commercial gain	0.11 ± 0.16	-0.2	0.43	1.11 ± 0.18	0.82	1.54	0.48
<i>Adherence to Covid-19 appropriate behaviour</i>							
Following Covid-19 appropriate behaviour	-0.01 ± 0.1	-0.21	0.19	0.99 ± 0.10	0.81	1.21	0.92
3. DON'T KNOW							
<i>Knowledge about Covid-19 in the paediatric population</i>							
Children more prone to impending waves	-0.6 ± 0.1	-0.8	-0.4	0.57 ± 0.09	0.43	0.78	<0.01
Severity and mortality are higher in children	-0.55 ± 0.15	-0.85	-0.25	0.54 ± 0.06	0.45	0.67	<0.01
<i>Paediatric Covid-19 vaccine information</i>							
Information source	-0.26 ± 0.09	-0.43	-0.09	0.77 ± 0.07	0.65	0.91	<0.01
Accessibility issues	-0.16 ± 0.11	-0.37	0.05	0.85 ± 0.09	0.69	1.05	0.14
Safety concerns	0.38 ± 0.18	0.02	0.73	1.45 ± 0.26	1.02	2.07	0.04
Unforeseen future effects	1.03 ± 0.17	0.7	1.37	2.80 ± 0.48	2.01	3.94	<0.01
Early approval	0.06 ± 0.1	-0.15	0.26	1.05 ± 0.11	0.86	1.30	0.58
Efficacy of vaccine	-0.3 ± 0.18	-0.65	0.05	0.74 ± 0.13	0.52	1.05	0.09
Commercial gain	0.37 ± 0.12	0.13	0.61	1.44 ± 0.18	1.14	1.83	<0.01
<i>Adherence to Covid-19 appropriate behaviour</i>							
Following Covid-19 appropriate behaviour	-0.35 ± 0.1	-0.54	-0.15	0.70 ± 0.07	0.581	0.858	<0.01

The response to knowledge or information was recorded as either no, don't know, or yes as 1, 2, and 3. Information sources were recorded on a scale from 1 to 4 where 1, 2, 3, and 4 denote through friends; news channels; social media; and healthcare workers/hospitals. Covid-19 behaviour was recorded as 1, 2, and 3 for continuing outdoor/school without any precautions; no outdoor/schooling; continue with mask/social distancing.

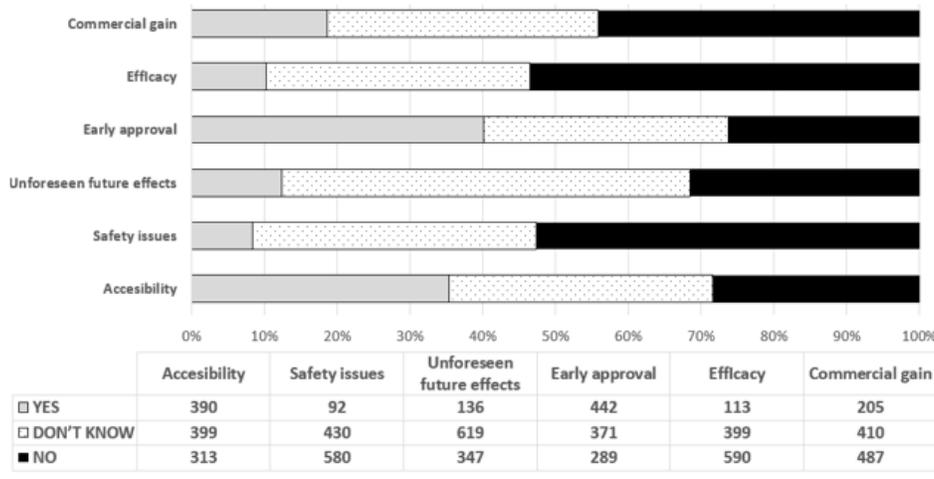


Figure 2: Common concerns regarding Covid-19 vaccines

Discussion

VH is defined as delay in acceptance or refusal of vaccination despite availability of vaccination services¹⁵. Our study shows that Covid-19 VH was 37.6% among survey respondents. VH was commoner among respondents concerned with short-term and long-term ill-effects from the vaccine. Parental vaccination status and vaccine-

related information received from healthcare workers were associated with a positive attitude towards vaccination. Rural background, lower education and previous Covid-19 exposure were not associated with significant VH in our study population.

Beneficial effects of vaccination have been

overwhelming. Although it may not prevent disease, a single or two doses provide 98.4% and 99.1% protection against mortality respectively⁴. As per UNICEF data, confirmed cases of Covid-19 among children and young adults (below 20 years of age) amount to 17% (22.9 million) of all cases globally and 0.4% (12,300) of all deaths attributed to Covid-19¹⁶. Sero-surveys in India have shown that children are as susceptible as adults to Covid-19¹⁷. However, severity of cases and death rates were significantly lower in children, Hence, some Indian paediatricians opine that Covid-19 vaccination is not needed universally for children¹⁸. However, experience from the United Kingdom shows that school age children comprised almost a third of hospitalized patients during October-November¹⁹. MIS-C is seen mostly in the age group 8-11 years, and nearly 60-80% require intensive care²⁰.

After the recession of the previous waves of the pandemic, there has been a steady waning of Covid-19 appropriate behaviours²¹. Nine percent of our study respondents confessed that they allowed their children to play outdoors and engage in indoor gatherings without masks; 79% parents allowed exposures only with masks. In previous surveys, around 50% school children have been reported to follow hand-hygiene and masking²². In the US, when schools reopened after the first wave, areas where masking in schools was not mandatory, reported higher number of cases and local outbreaks²³. These behavioural patterns were not associated with VH in our study¹⁵. Although data show that children were equally affected in both first and second waves, a significant proportion of our respondents believed that the 3rd wave will affect children more. The most plausible explanation provided was that while adults are eligible for vaccination, children are still deprived of access to vaccination²⁴⁻²⁶.

It is important to understand the barriers to wide acceptance of COVID-19 vaccination among children, given that children, even though asymptomatic, can transmit infection to vulnerable contacts. Previous studies have been bidirectional regarding the effect of age on Covid-19 VH. Some studies showed that younger ages are more willing for vaccination, while others showed a reverse trend²⁷. Younger age respondents in our study showed lower VH. Females have been more hesitant towards vaccination in most studies^{28,29}. We report a similar trend. A major reason for heightened VH among women is circumspection, being worried about the safety of vaccines³⁰. Respondents from rural areas and lower socioeconomic classes also reported more VH. Our study did not find the effect of rural origin on VH, probably because of poor rural representation in our study. Parents who have received the vaccine themselves were more likely to

vaccinate their children³¹. Vaccine acceptance was significantly higher in respondents concerned about frequency and severity of Covid-19 among children in impending waves in our study. Parents' concern regarding frequency and severity of Covid-19 infection in children has been consistently shown to be associated with higher vaccine acceptance across several studies^{32,33}. In contrast to most previous studies, our study did not find that the rapid development and expedited approval of Covid-19 vaccines contributed significantly to VH. Possibly, the sturdy safety track-record of all major vaccines has kindled confidence about vaccines in the public.

The source of vaccine related information also bore significantly on VH, as has been the trend in previous studies. Respondents who relied on social media reports were more circumspect towards vaccination. As opposed to traditional media, social media allow users to consume and share information without editorial oversight. Users self-select content leading to unsuspected 'ideological isolation'³⁴. Educational drives on television, print media and social media have been shown to consistently improve vaccine acceptance among target populations³⁵.

There were some limitations. Surveys may underestimate the actual VH. Our survey population was mostly urban and the rural, lower socioeconomic and less-educated strata of society were underrepresented. Thus, the results may not be generalizable to all populations.

Conclusions

Age, gender, Covid-19 vaccination status of parents and perception of severity of Covid-19 among children were major determinants of VH in our study. Source of vaccine-related (mis)information concerns related to short-term and long-term safety of vaccines was significantly associated with VH.

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