

Original Research Article

Factors influencing pediatric vaccine acceptance among parents: a cross-sectional study

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ABSTRACT

Background: Vaccines drastically reduce disease burden, eliminate and even eradicate highly infectious illnesses. The efficacy however highly depends on herd immunity. This paper aims to identify the prevalence and causes of vaccine hesitancy and attempts to find solutions to maintain herd immunity.

Methods: This cross-sectional study was conducted in a tertiary care hospital, obtaining data from parents visiting the pediatric clinics. Data collected including demographic information, the core vaccine hesitancy survey and data to elucidate parental attitude towards vaccination. Analysis was done with a Chi square test with level of significance at 0.05.

Results: Mothers with a lesser education and parents who were unemployed or were unskilled workers had increased vaccine hesitancy. While most agreed that vaccines protected children, 3.8% were reluctant to vaccinate and 6.9% had not vaccinated their child. 51.3% stopped after the MR vaccine and 20.5% after the second DPT booster. The most common reason was a poor past experience or adverse reaction. 10.26% did not know where to obtain reliable information and 7.7% were concerned about side effects. A majority agreed that vaccines are important, however, 3.5% continued to remain hesitant to vaccinate their children.

Conclusions: Vaccine hesitancy has reasons specific to each population group. It is imperative that strategies to improve vaccination focus on factors identified and alleviate the concerns outlined. A systemic multi-faceted approach at the national, state, district and school level along with creative means to ensure comprehensive education during each well child and vaccine visit can aid minimize hesitancy.

Keywords: Reluctance, Vaccination, Vaccine hesitance

INTRODUCTION

Vaccines are arguably one of the greatest public health interventions of our lifetime. They have led to the reduction, elimination and even eradication of infectious diseases that were the leading causes of morbidity and mortality in children. The effectiveness of the vaccine however, relies on a large number of individuals in the community being immunized or herd immunity. To achieve maximum coverage the global vaccine action plan of the World Health Organization called for nations

to achieve 90% coverage of their populations.¹ This goal was not achieved largely due to a rapidly developing phenomenon called ‘vaccine hesitance’. Vaccine hesitance is defined by the World Health Organization as “the delay in the acceptance or refusal to vaccinate despite the availability of vaccine services”.² It is the hesitance that lies between full acceptance and outright refusal of vaccines. This has led to outbreaks of vaccine preventable diseases in unvaccinated pockets all around the world.

In India, while neonatal and maternal tetanus has been eliminated and the country has been recently certified as free from poliomyelitis, vaccine coverage remains below par. A survey by the ministry and health and family welfare of India in 2015 concluded that only 62% children in the country are fully immunized for age.³ This has been attributed to either populations residing in hard-to-reach areas or those that hard to immunize.⁴ The latter poses a massive challenge to the immunization programs across the world.

Vaccine hesitant people may be those who hesitate but may eventually agree to vaccinate their children, those who delay vaccination or those who eventually refuse to vaccinate their children. Many countries reported fears of potential risks a major factor behind vaccine hesitancy but vaccine hesitancy is a far more complex phenomenon driven by various communal, societal and behavioural factors influencing a parent or guardian.⁵

There may also be flaws in the vaccine availability due to lack of stocks, limited vaccination due to natural or man-made disasters or other factors not under the control of the parent. While the major cause of hesitance remains fears and mistrust, another burgeoning trend seems to be vaccine complacency where people perceive the risk of contracting a vaccine preventable disease as low and therefore do not consider vaccination as essential.^{6,7} It has recently also been found that several vaccinated individuals too have concerns about the vaccines they receive.⁸

The most recent and well-known example of this phenomenon is the COVID-19 vaccine. While the rapid development of the COVID-19 vaccine benefitted millions, several others began to mistrust the scientific data and the seeds of doubt led to reluctance and refusal over not just the COVID vaccine but vaccines in general.⁹

This alarming trend is growing world over and India has already begun to experience the effects of loss of herd immunity with sporadic measles outbreaks, resurfacing cases of mumps, poliomyelitis and pertussis and cases of severe COVID-19 in children in the last 2-3 years.

While the threat posed by vaccine hesitancy is well known, the reasons for vaccine hesitancy in the densely populated clusters of Mumbai have not been thoroughly explored. By understanding the prevalent reasons for vaccine hesitancy, a more focused plan of action can be implemented to eradicate vaccine hesitancy and restore the miraculous protection immunization provides.

The objectives of this study include to identify the prevalence of vaccine hesitancy among parents visiting the Pediatric outpatient department. To identify the factors leading to the vaccine hesitancy in this population. To identify and recommend ways to counter the identified causes of vaccine hesitancy in an attempt to increase the rate of vaccination.

METHODS

Study type

This was a cross-sectional study.

Study place

The study was undertaken in the pediatric outpatient clinic of Lokmanya Tilak Municipal Medical College and General Hospital, Mumbai.

Study duration

The study was conducted between 1st June, 2023 to 20th September, 2023.

Sample size calculation

The sample size was calculated using Cochran's formula for estimating a single population proportion. After institutional ethics permission was obtained (IEC/53/23, June 8th, 2023), parents visiting the pediatric outpatient department were approached.

Inclusion criteria

Inclusion criteria for this study consisted of parents of children 12 years and under in age visiting the pediatric outpatient department and consenting to participate in this study.

Exclusion criteria

The exclusion criteria were children with known medical contraindication to immunization and children diagnosed with immunodeficiency disorders. The parents/guardians were briefed about the objectives of the study. Once written, informed consent in a language best understood by them was obtained, questions for the questionnaire were asked and recorded in the patient information sheet.

Data collection

The data collection sheet was divided into three sections. The first section included socio-demographic information of the participants including age of both parents, age and gender of their child, education of the mother, occupation of both parents, number of siblings, religion, type of family and site of routine immunization. The second encompassed a core vaccine hesitancy survey and the third section attempted to elucidate parental attitude towards vaccination (PACV).¹⁰ The PACV is a pre-validated questionnaire assessing a parent's attitude towards immunization behavior, beliefs about vaccine safety and trust and efficacy. Socio-economic status was evaluated using the Modified B.G. Prasad Scale.¹¹

Statistical analysis

Data collected was analyzed to identify common causes of vaccine hesitancy and their prevalence in the study population. The data was entered into Microsoft Excel (Windows 7, Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0, SPSS Inc, Chicago). Calculated PACV scores ranged from 0-100 with scores of 0-49 indicating no VH and 51-100 indicating presence of VH. Descriptive statistics such as mean and standard deviation (SD) for continuous variables, frequencies and percentages were calculated for categorical Variables were determined. Association between Variables was analyzed by using Chi-Square test for categorical Variables. Level of significance was set at 0.05. Vaccines included in this study are those which are available at the government run hospitals as per the National Immunization Schedule of India.¹²

RESULTS

Out of the 562 subjects included in the study, 308 (54.8%) were male and 254 (45.2%) were female. The mean age of all the child participants was 5.76 with a standard deviation of 3.44.

No statistical significance was found between the age of the child and vaccine hesitancy. 99.8% reported the mother to be the primary caregiver of the child. A majority i.e., 231 (41.1%) reported having 1 sibling while only 3 (0.6%) reported having 5 or more siblings. The mean age of mothers was found to be 26.92 (19-45) while that of fathers was 30.24 (20-50). Neither parent's age had a significant impact on vaccine hesitancy.

On documenting the mother's education, it was found that 362 mothers (64.4%) had a high school degree, 142 (25.1%) had completed middle school, 32 (5.7%) had a bachelor's degree, 26 (4.1%) were primary school graduates and 1 (0.2%) was uneducated. This was statistically significant with more middle school graduates found to be hesitant to vaccines (p -value<0.001). When comparing occupations, 223 mothers (39.7%) and 233 fathers (41.5%) did unskilled labour, 111 (19.8%) mothers and 205 (36.5%) fathers performed semi-skilled work, 6 (1.1%) mothers and 12 (2.3%) fathers did skilled work, 33 (5.9%) mothers and 75 (13.3%) fathers were clerks, 1 (0.2%) mother and 2 (0.4%) fathers had a professional occupation while 188 mothers (33.5%) and 33 (5.9%) fathers were unemployed.

This was statistically significant with unskilled workers and unemployed parents were found to have a higher rate of vaccine hesitancy (3.7% and 1.8% for mothers and 12.1% and 2.1% for fathers respectively, p value<0.001). 272 or 48.4% lived in joint families while 290 (51.6%) lived in nuclear families. When comparing the socio-economic status of the subjects, majority i.e., 262 or

46.6% of the families interviewed belonged to the lower class 219 or 39% in the lower middle socio-economic class, 79 (14.1%) in the middle class and 2 or 0.4% belonged to the upper-middle class. No statistical significance was found when socio-economic status was compared to vaccine hesitancy. 99.5% patients were immunized at the hospital while 0.5% at local primary care centers. This was statistically significant (p value: 0.008) 561 or 99.8% of all subjects interviewed believed that vaccines protect from serious diseases. All the subjects interviewed felt that most parents had the children vaccinated with all the recommended vaccines. However, 21 or 3.8% caregivers were found to have been reluctant or hesitant in vaccinating their wards and 39 or 6.9% had either refused or forgotten to vaccinate their child in the past. Among those who had not gotten their children vaccinated, 51.3% or 20 had stopped after the MR vaccine and 8 or 20.51% had stopped after the second DPT booster as per the national immunization schedule (Table 1).

Among those who were reluctant to or did not get their ward vaccinated, 25.64% provided the reason as having had a poor experience or reaction with previous vaccination/ vaccination of the older sibling, 20.51% felt as 'other reasons not mentioned in the form'. 20.51% did not know where to obtain the vaccination while 15.38% were unable to leave their workplace for the scheduled appointments. 10.26% did not know where to get reliable information about the vaccines, 7.69% felt vaccination was not needed for their child while 7.69% were concerned about the side effects and did not feel the vaccines were effective. 558 or 99.3% patients said they had no external pressures preventing their child from getting vaccinated. Only 3 or 0.6% had heard negative information about vaccines but all of them were willing to vaccinate their wards despite that. No participants had any community or religious leaders who preached against vaccines.

We then attempted to identify perceptions of vaccine safety. We found a median PACV score of 10 with a total of 540 parents. 71.2% or 400 participants agreed and 24.4% or 137 strongly agreed that vaccines were important for their child's health and 460 (81.9%). 432 or 76.9% agreed and 117 or 20.8% strongly agreed vaccines are effective. 442 (78.6%) agreed and 34 (6%) strongly agreed that having their child vaccinated was important for the health of others while 80 (14.9%) were unsure and 2 (0.4%) disagreed. 78.1% agreed that all vaccines offered by the government program were beneficial.

63.9% or 359 participants did not agree that newer vaccines carried more risks than older vaccines while 131 or 23.3% were unsure. 90.6% or 509 participants agree and a further 27 (4.8%) strongly agree that the information they receive about the vaccines is reliable and trustworthy. 81.9% feel vaccines are a good way to protect their children from disease. 1.4% or 8 participants are concerned while 10 or 1.8% are strongly concerned

about the adverse effects of vaccines. 14 or 2.5% are feel that their children do not need vaccines for diseases that are not common anymore while 37 or 6.6% were unsure about the need (Table 4).

485 (86.3%) participants disagreed and 30 (5.3%) strongly disagreed that children are given more shots than are beneficial to them, 94.1% participants agreed that most of the illnesses these shots prevent are serious and 94.7% disagreed when asked if it is better for the child's immunity to get sick than to get shot. However, 519 (92.3%) feel and 16 (2.8%) strongly feel that it is better

for their wards to get fewer vaccines at the same time. 11 participants or 1.96% were concerned that childhood vaccines may not be safe and 0.4% felt they may not prevent disease (Table 5).

32 participants or 5.7% delayed vaccination for their children while 25 or 4.4% outright refused. 95.37% stated that they would follow the immunization schedule for their other children. Overall, 20 or 3.56% participants remained hesitant while 2 or 0.4% continued to remain very hesitant to vaccinate their child and siblings (Table 6).

Table 1: Distribution of study subjects according to gender (n=562).

Gender	No.	%
Male	308	54.8
Female	254	45.2

Table 2: Distribution of study subjects according to age.

Age (in years)	No.	%
≤1	34	6
01-March	146	26
04-June	165	29.4
07-December	202	35.9
>12	15	2.7
Mean (SD)	5.76 (3.44)	
Range	0.25-22.0	

Table 3: Distribution of study subjects according to the refused vaccines (n=39).

Vaccines	No.	%
All after birth	2	5.1
BCG onwards	1	2.6
DPT Booster 2	8	20.5
MR onwards	20	51.3
MR, IPV	1	2.6
None after 6 weeks	2	5.1
Pentavalent dose 2, onwards all except OPV	5	12.8

Table 4: Distribution of study subjects according to the vaccine hesitancy (n=562).

	1 N (%)	2 N (%)	3 N (%)	4 N (%)	5 N (%)
Childhood vaccines important for my child's health	-	4 (0.7)	21 (3.7)	400 (71.2)	137 (24.4)
Childhood vaccines are effective	-	4 (0.7)	9 (1.6)	432 (76.9)	117 (20.8)
Having my child vaccinated is important for the health of others in my community	-	2 (0.4)	84 (14.9)	442 (78.6)	34 (6.0)
All childhood vaccines offered by the government program in my community are beneficial	-	5 (0.9)	36 (6.4)	439 (78.1)	82 (14.6)
New vaccines carry more risks than older vaccines	54 (9.6)	359 (63.9)	131 (23.3)	15 (2.7)	3 (0.5)
The information I receive about vaccines from the vaccine program is reliable and trustworthy	-	1 (0.2)	25 (4.4)	509 (90.6)	27 (4.8)
Getting vaccines is a good way to protect my child/children from disease	-	1 (0.2)	20 (3.6)	460 (81.9)	81 (14.4)
Generally, I do what my doctor or health care provider recommends about vaccines for my child/children	-	-	10 (1.8)	411 (73.1)	141 (25.1)

Continued.

	1 N (%)	2 N (%)	3 N (%)	4 N (%)	5 N (%)
I am concerned about serious adverse effects of vaccines	47 (8.4)	447 (79.5)	50 (8.9)	8 (1.4)	10 (1.8)
My child/children do or do not need vaccines for diseases that are not common anymore	102 (18.1)	409 (72.8)	37 (6.6)	14 (2.5)	

(scale 1=strongly disagree to-scale 5=strongly agree)

Table 5: Distribution of study subjects according to the perceptions (n=562).

	Strongly agree N (%)	Agree N (%)	Not sure N (%)	Disagree N (%)	Strongly disagree N (%)
Children get more shots than are beneficial to them	3 (0.5)	13 (2.3)	31 (5.5)	485 (86.3)	30 (5.3)
Most of the illnesses these shots prevent are severe	13 (2.3)	529 (94.1)	20 (3.6)		
It is better for the child's immunity to get sick than to get a shot		1 (0.2)	8 (1.4)	532 (94.7)	21 (3.7)
Better for children to get fewer vaccines at the same time	10 (1.8)	185 (32.9)	17 (3.0)	347 (61.7)	3 (0.5)
I trust the information I receive about the vaccines	16 (2.8)	519 (92.3)	27 (4.8)		
I can openly discuss my concerns about the vaccine with the child's doctor	9 (1.6)	540 (96.1)	13 (2.3)		

Table 6: Distribution of study subjects according to the overall hesitancy (n=562).

Overall hesitancy	No.	%
Hesitant	20	3.56
Not hesitant	536	95.37
Not sure	2	0.36
Very hesitant	2	0.36

DISCUSSION

The success of a large-scale immunization program relies heavily on high vaccine coverage and vaccine acceptance. A successful program can effectively reduce the outbreak of vaccine preventable diseases among the vaccinated and the un-vaccinated via herd immunity.

Recent outbreaks of measles beginning in developed countries and now even being found in India undermines the significant impact of maintaining both access to and trust in the vaccination program.⁸ The analysis of WHO/UNICEF Joint Reporting Form data for VH in the years 2015-2017 revealed VH present in over 90% of all WHO member countries. The recent outbreaks of measles have also been conclusively attributed to VH.¹³

The proportion of participants found to be vaccine hesitant at 3.56% was comparatively low in our study. Vaccine hesitancy in several parts of the country range from 14% to as high as 83% whereas, world over it ranges from as low as 1.1% to as high as 76% in a study conducted in Nigeria.¹⁴⁻¹⁶ High literacy seems to

have placed a significant impact with most of the mothers or primary caregivers who were hesitant to vaccinate their child were middle school graduates while those who graduated high school or had a college degree were significantly less hesitant. A similar trend was found when comparing the employment status of both parents with parents engaged in unskilled labour or parents who were unemployed were less inclined to fully vaccinate their child. These findings were echoed in a study done by Agarwal et al and Dasgupta et al, but a study done by Thapar R et al, in South India showed no association with mother's educational status or employment.^{4,15,17} These contrasting observations in the same country imply that VH need to be dealt at a local level after understanding individual concerns rather than a blanket national campaign. In our study socio-economic status had no statistical significance with vaccine hesitancy.

Identifying, understanding and overcoming the reasons for delayed or refused vaccinations is paramount to fighting vaccine hesitance. The most common causes cited for refusal to vaccinate include concerns regarding safety of the vaccine, lack of awareness or knowledge

regarding vaccination and cultural or religious beliefs.¹⁸ In our study however, the most common reason parents delayed or even refused vaccination was a poor prior experience with over one-fourth of the parents citing a poor experience with the past vaccine, reactions to the vaccine and poor experience with an older sibling making them hesitant to vaccinate their younger children.

This trend was predominant in the South and south-east Asian countries.⁴ While most were convinced about the positive role of vaccination in the ward's health, they were unaware of common, expected and unexpected adverse reactions to vaccination and were apprehensive due to their children and their siblings falling ill post vaccination. 21% stated reasons not mentioned in our questionnaire, some of which included recent migration and apprehensions of taking their child to a hospital in a big city, having forgotten about the vaccination dates for their child or intimidation by the long waiting and rigid timings at the vaccination centers. While not statistically significant, this trend was particularly noticed in nuclear families or families with elderly or disabled members.¹⁹ Mothers, often were overwhelmed as primary caregivers for their children among other responsibilities and were unable to timely vaccinate their children.

This was also seen amongst those who frequently migrated for work and those who relied on daily wages to survive. The third most common reason cited in our study was unawareness on where to obtain reliable information. Several parents were unsure if they could obtain different vaccines in different locations or were unsure if they had any upcoming vaccination appointments. This was similar to a study by Domek et al, in Guatemala where logistical factors such as distance to clinic, cost of travel to the vaccine clinic etc, were inhibiting factors in vaccination.¹⁰ About one tenth of the parents did not know where to obtain reliable information about the vaccine.

Parents are often overwhelmed by contradicting information from several sources including several popular social media sites and do not know which information was reliable. This often-created doubts and translated to fear of vaccination and its side-effects.⁴ 7.69% felt their ward did not need the vaccine and another 7.69% were concerned about the possible adverse reactions to the vaccines both in the short and the long term. This was also indicated in our study where an increasing number of parents wished for fewer vaccines to be given together in the same appointment for fear of adverse reactions. A study by Dasgupta et al, in Siliguri showed unwillingness and lack of reliable information as the most common cause of VH while a study by Dube et al, in Quebec showed low perception of vulnerability to vaccine preventable diseases as the most common cause.^{17,20}

It is not unknown that those who do not have enough knowledge about immunization often portray a negative

attitude towards it and have a lack of trust in the institutions that promote it.²¹ This was displayed in our study where most of the parents who positively viewed vaccines and agreed that they prevented serious illnesses were more likely to have vaccinated their child and continue to vaccinate in the future as well. Several studies showed religious and spiritual influences leading a VH which included but were not limited to the reluctance to use vaccines made from human cell lines or adoption of a holistic approach which believed in natural healing over the immunity created by the use of vaccines. These created a unique problem as it was not the lack of awareness but a conviction against the concept of immunization, making it harder to convince these patients to change their beliefs.^{22,23} This reason for VH was not found to be prevalent in the patient population questioned in our study and there was no statistical association between the patient's religious beliefs and VH. This was evident at the time of the COVID-19 vaccines, when several religious groups in India supported and promoted vaccination as a way to diminish the chance of serious illness.²⁴

Limitations

This study is limited to one facility and findings may be used as reference but cannot be generalized to the general populations.

CONCLUSION

This study has shown the existence of vaccine hesitancy in all groups of the community but also indicated that the reasons for the hesitancy are varied and context specific. This study also highlights the low rates of vaccine hesitancy in Mumbai compared to the rest of the country. Vaccine hesitancy has been rightfully described as an iceberg phenomenon with the tip representing those who outright refuse vaccines while a major submerged section representing those who are hesitant and apprehensive. Population based multicentric studies can assist in identifying this population. It is imperative that strategies to improve vaccine acceptance focus on factors identified and try and alleviate some of the concerns outlined.

Recommendations

Expanding vaccination centres to pre-existing health centres in slums and rural areas will bring vaccines closer to people's homes and expanding the use of literature in accessible ways to educate parents will promote confidence in vaccines. A systemic multi-faceted approach at the national, state, district and even school level education along with creative means to ensure comprehensive education during each well child and vaccine visit can be a constructive way to minimise hesitancy.

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