Original Article

Access this article online

Quick Response Code:

Website: www.jehp.net

DOI: 10.4103/jehp.jehp_687_22

Prevalence and predictors of vaccine hesitancy among mothers of under-five children: A hospital-based cross-sectional study

Narayana Goruntla, Kokkala Akanksha[1], Katta Lalithaasudhaa[1], Vikash Pinnu[1], Dasaratharamaiah Jinka[2], Pradeepkumar Bhupalam[3], Jyosna Doniparthi[4]

Department of Clinical Pharmacy and Pharmacy Practice, School of Pharmacy, Kampala International University (KIU), Western Campus, Uganda, [1]Department of Pharmacy Practice, Raghavendra Institute of Pharmaceutical Education and Research (RIPER) - Autonomous, Anantapur, Andhra Pradesh, India, [2]Department of Pediatrics, Rural Development Trust Hospital, Bathalapalli, Andhra Pradesh, India, [3]Department of Pharmacology, Raghavendra Institute of Pharmaceutical Education and Research (RIPER) - Autonomous, Anantapur, Andhra Pradesh, India, [4]Department of Pharmaceutics, Sri Krishnadevaraya University College of Pharmaceutical Sciences, S.K. University, Anantapuramu, Andhra Pradesh, India

Address for correspondence:
Dr. Narayana Goruntla, Department of Clinical Pharmacy and Pharmacy Practice, School of Pharmacy, Kampala International University (KIU), Western Campus, Uganda.
E-mail: narayanagoruntla@gmail.com

Received: 16-05-2022
Accepted: 17-06-2022
Published: 31-01-2023

Abstract:

BACKGROUND: The World Health Organization (WHO) states that vaccine hesitancy is one of the top 10 threats to global public health. Evidence shows that vaccine hesitancy studies in India are limited and targeted toward individual vaccines. The study aimed to fill this gap by exploring the relationship between demographics and SAGE factors toward vaccine hesitancy.

MATERIALS AND METHODS: A hospital-based, cross-sectional, analytical study was conducted in a non-governmental organization (NGO) hospital with 330 beds, located in Bathalapalli, Andhra Pradesh, India. Mothers of under-five children who attended outpatient departments of pediatrics or obstetrics and gynecology were included. A total of 574 mothers were enrolled and vaccine hesitancy was determined by reviewing the mother–child protection card for the presence of delay or refusal of the recommended vaccine. A face-to-face interview was conducted to obtain demographics and WHO–SAGE variables from the participants. Binary logistic regression analysis was performed to associate independent variables (demographics and SAGE variables) with the dependent variable (vaccine hesitancy).

RESULTS: Out of 574 respondents, 161 mother's children were noted as vaccine-hesitant (refusal = 7; delay = 154); and the prevalence of vaccine hesitancy was 28.05%. The delay was observed in all recommended vaccines, but the refusal or reluctance was seen in only four vaccines (hepatitis B birth dose = 1; IPV 1 and 2 = 2; Measles 1 and 2 = 3; and Rota 1, 2, and 3 = 1). The respondents' demographics like no or lower parent education (OR = 3.17; 95%CI = 1.50–6.72) and fewer antenatal visits (OR = 2.30; 95%CI = 1.45–3.36) showed higher odds, whereas the upper socioeconomic status showed lower odds (OR = 0.09; 95%CI = 0.02–0.36) toward vaccine hesitancy. The WHO–SAGE dimensions like awareness (OR = 0.14; 95%CI = 0.03–0.53), poor access (OR = 7.76; 95%CI = 3.65–16.51), and low acceptability of the individual (OR = 07.15; 95%CI = 1.87–27.29), community (OR = 6.21; 95%CI = 1.58–24.33) were significantly associated with vaccine hesitancy.

CONCLUSION: The study concludes that the prevalence of vaccine hesitancy was high. Vaccine safety and children's health are primary concerns for parents' refusal/reluctance. To achieve 100% immunization coverage, policymakers need to reduce vaccine hesitancy by developing strategies based on demographic and WHO–SAGE working group predictors.

Keywords:

Childhood vaccination, immunization coverage, vaccine delay, vaccine hesitancy

Introduction

Vaccination is the most successful and cost-effective practice to improve Economic and health outcomes against some infectious diseases.[1,2] Universal immunization programs gave rise to major reductions in global morbidity and

How to cite this article: Goruntla N, Akanksha K, Lalithaasudhaa K, Pinnu V, Jinka D, Bhupalam P, *et al*. Prevalence and predictors of vaccine hesitancy among mothers of under-five children: A hospital-based cross-sectional study. J Edu Health Promot 2023;12:34.

mortality in children less than five years of age from vaccine-preventable diseases.[3] Global immunization coverage declined from 86% in 2019 to 83% in 2020, according to the World Health Organization (WHO) statistics from 2020. The number of children under the age of one year who are entirely unvaccinated increased by 3.7 million in 2020 compared to 2019 and is now at its highest level since 2009.[4]

According to a 2011 survey, 23.5 million children are not immunized, and 1.7 million children die due to vaccine-preventable diseases every year.[5] Two to three million deaths have been prevented due to vaccination every year, and 1.5 million deaths can be prevented if vaccination is given in a planned period.[6] According to the 2019 census, India is the world's second-largest country without the first dose of the diphtheria-tetanus-pertussis vaccine.[7] Official country estimates show that over 90% of children have been administered Bacillus Calmette-Guerin, the third dose of the diphtheria-tetanus-pertussis vaccine, and the third dose of the polio vaccine, and the measles vaccine.[8] As per the 2012–13 survey, only 59% of children 12–48 months were fully vaccinated.[9] In the past 30 years, merely 62% of children have been fully immunized, according to the National Family Health Survey (NFHS 4).[10] India considers pediatric vaccines like Hemophilus influenzae type b vaccine (Hib) in its Universal Immunization Program.[11] The government of India initiated Intensified Mission Indra Dhanush program in 2017 with a strategy to target underserved, vulnerable, resistant, and inaccessible populations.[12]

With the enormous progress achieved in immunization, there are increasing parental concerns about vaccine safety or efficacy in their children.[13] Vaccine hesitancy is a common barrier to vaccination. It has been defined by the Strategic Advisory Group of Experts (SAGE) working group as the ''delay in acceptance or refusal of vaccination despite the availability of vaccination services".[14] Vaccine hesitant individuals are part of a heterogeneous group and have different levels of concern about vaccines, ranging from those who refuse vaccines entirely to individuals who refuse or delay specific vaccines and those who have doubts and concerns about vaccination but accept all vaccines.[13] The WHO stated vaccine hesitancy as one of the ten global health threats the world faces in 2019 in its five-year strategic plan.[15] Vaccine hesitancy is influenced by factors that include (1) confidence, which is the lack of trust in the vaccine or provider, (2) complacency, which is the perception that there is no value or a need for a vaccine; and (3) convenience, which refers to the perceived lack of access or services toward vaccination.[16]

Most vaccine hesitancy research has been conducted in high-income countries. Still, the prevalence of factors related to vaccine hesitancy can be understood only if surveys are conducted irrespective of the country's level of economic development. The SAGE working group has also mentioned that the scope of vaccine hesitancy will not consider external factors like vaccine accessibility (lack of public health policies and finances), vaccine stock-out issues, and cold chain readiness.[17] Most parents follow alternative vaccination and refuse one (or) more childhood vaccines. Through social networks, vaccine-hesitant parents may acquire misinformation and cultural, political, and personal influence about the risk and benefits of vaccines.[2,14] It is also known that parents who lack adequate knowledge about vaccines or vaccine preventable diseases (VPDs) are more likely to have negative attitudes towards immunizations, providers, immunization requirements and trust in the individuals and institutions responsible for immunization policy.[18] Parent vaccination decisions are often accompanied by emotions, past experiences, and the views and opinions of peers. As a result, dissolving doubts about vaccination can be difficult and time-consuming.[19,20] Vaccine hesitancy, thus, risks the public health consequences of vaccine-preventable disease outbreaks.[21]

A vaccine hesitancy survey should be done to properly understand the prevalence of vaccine hesitancy in communities or hospitals and the factors responsible for the incomplete immunization of under-five children in India. This study aimed to fill this gap by exploring the relationship between sociodemographic and SAGE working group factors toward vaccine hesitancy.

Materials and Methods

Study design and settings

A hospital-based, cross-sectional, analytical study was conducted in a 330-bedded non-governmental organization (NGO) hospital located in a small village Bathalapalli, Anantapur District, Andhra Pradesh, India. The study was conducted for a period of six months from July to December 2021.

Study participants and sampling

Mothers with at least one child ≤ five years of age who attended the outpatient departments of pediatrics or obstetrics and gynecology were included in the study. Mothers who were not willing to give consent and were unaware of the previous immunization status of the child were excluded from our survey.

Epi-Info-7 Dos Version 7.2.5.0 software was used to estimate the sample size by considering 29.0% of vaccine hesitancy estimated in a community-based,

cross-sectional survey conducted in Delhi, India.[22] By setting a 4% (95% CI: 25%–33%) margin error, 80% of power, 1% of design effect 1%, the sample size was estimated as 497. By assuming a 10% of non-response rate from the participants, the final sample size obtained was 547. The eligible participants were selected for the study by using a non-random (convenient) sampling technique.

Data collection tool and technique

The data collection tool consists of four sections: (1) sociodemographic profile of the parents and children; (2) SAGE working vaccine hesitancy survey questionnaire (core close-ended questions); (3) determination of vaccine hesitancy; and (4) reasons for vaccine hesitancy (open-ended question)

Demographic profile of the parents and children

Demographics like mother's age, birth order, youngest child's age, youngest child's gender, type of family (nuclear or joint), parents' education, location, socioeconomic status (modified Kuppuswamy scale), religion, distance from vaccination site, and the number of antenatal visits were included in this section.

SAGE working vaccine hesitancy survey questionnaire

The study adopted a questionnaire developed by the SAGE working group. The questionnaire comprises of 11 questions distributed under four sections: awareness, access, acceptance at the individual level, and acceptance at the community level. The questionnaire measures the mother's awareness of vaccine efficacy, existing accessibility barriers in obtaining vaccines, vaccine refusals, reasons for the same at the individual level, and political or religious concerns for vaccine recommendation.

Determination of vaccine hesitancy

All the enrolled mothers were interviewed regarding vaccines given to their children. The mother and child protection (MCP) card was checked to examine vaccination status according to the child's age. Vaccine hesitancy was considered to be present in those families who refused or were reluctant, or delayed any of the recommended vaccine doses, as per the age (0–60 months) of the child.

Reasons for vaccine hesitancy

The respondent was given an open-ended question, "What are the likely reasons for your child's refusal/vaccination delay?" All of the reasons given by the parents for vaccine hesitancy were collected and recorded.

Language validation of the data collection tool

The study adopted a WHO–SAGE working group vaccine hesitancy questionnaire. The questionnaire was translated from English to Telugu by a professional translator. The Telugu version questionnaire was verified for linguistic equivalence of terms and concepts by the back-translation from Telugu to English. The study tool was not subjected to any content validity or reliability test because the WHO–SAGE working groups recommended the standard questionnaire to assess the factors associated with vaccine hesitancy.

Data collection technique

The eligible mothers were explained about the study's objectives, protocol, and expected outcomes before enrolling in the study. A total of 612 eligible mothers were approached to participate in the study. Among the 612 respondents, 18 were not interested in enrolling, and 20 were not aware of the previous immunization status of their child, all of whom were excluded from the trial. During the study period, a face-to-face interview was conducted with 574 mothers in the outpatient department of pediatric or obstetrics and gynecology departments. The interview lasted an average of 15 minutes. A pre-designed survey tool was used to collect the data regarding demographics, SAGE working group predictors, vaccine hesitancy, and reasons for vaccine hesitancy.

Data analysis technique

IBM SPSS software for Windows, version 22.0 (IBM Corp., Armonk, NY, USA) was used to analyze data collected from the respondents. Data were cleaned, sorted, and processed before starting analysis in a Microsoft Excel spreadsheet. Binary logistic regression analysis was performed to examine the association of independent variables (demographics and SAGE working group variables) with the dependent variable (vaccine hesitancy refusal or delay).

Ethical consideration

The study proposal, tools, and informed consent procedure were approved (RIPER/IRB/PP/2021/002) by the Institutional Review Board (IRB) prior to trial initiation. No monetary incentive was provided to participants, and anonymity was maintained to ensure the confidentiality and reliability of the data. The mothers had complete liberty to refuse participation in the study. The survey was conducted in compliance with the provisions of the Declaration of Helsinki 1975 regarding research on human subjects.

Results

Vaccine hesitancy

Out of 574 respondents, 161 mother's children were noted as vaccine-hesitant (refusal = 7; delay = 154); and the prevalence of vaccine hesitancy was found to be 28.05%. The study findings reveal that all vaccines were

delayed in administering to at least one child. More than 80% of the children were fully vaccinated according to their age as per the Universal Immunization Program. The rate of delay, refusal, and no delay for the individual vaccine was represented in Table 1.

Reasons for vaccine hesitancy

The most common reasons expressed by the mothers for vaccine hesitancy included health issues in the baby (67; 11.67%) and vaccine safety (33; 5.75%). The distribution of the reasons expressed by the vaccine-hesitant mothers are represented in Table 2.

Demographics

In the current study, the majority of the respondents were aged 21–30 years, the first order of birth more than equal to 12 months for the younger child, male child, nuclear family, high school education, rural residence, lower middle class, Hindus, and staying distance for less than 10 km.

The binary logistic regression analysis findings revealed that joint family and higher socioeconomic status (class I, II, and III) were significantly associated with non-hesitancy toward vaccination among children. At the same time, the lower educational status of parents and less than four antenatal visits were significantly associated with vaccine hesitancy. The association of respondents' demographics with vaccine hesitancy was represented in Table 3.

SAGE working group constructs

The majority of the parents knew that vaccines protect their children from infectious diseases (98.08%) and that they must vaccinate their children against recommended vaccines (96.34%). Only a few parents (6.23) addressed long distance as a barrier to vaccine uptake. . Due to some other pressures, parents shown hesitancy towards vaccine uptake (27.7%) Parents' reluctance and refusal of vaccine uptake for their children are very low (1.92%, 1.04%). The majority (99.65%) of the mothers said that leaders (healthcare workers, religious leaders, and politicians) in their community support the vaccination among children less than five years. Table 4 shows the distribution and association of SAGE working group variables (awareness, access, acceptability at individual and community levels) toward vaccine hesitancy among mothers bearing children less than five years.

Discussion

Achievement of high vaccine coverage and uptake rates are essential in controlling the VPDs. However, recent outbreaks of VPDs like measles and diphtheria in both developed and developing countries show the gap present in the progression of immunization programs implemented globally.[23] The global vigilance on immunization programs in developed countries revealed a recent measles outbreak due to vaccine hesitancy.[23] This confirms that vaccine hesitancy is a universal problem irrespective of a developed or developing nation. The WHO/UNICEF data for 2015–2017 revealed that more than 90% of WHO member countries reported vaccine hesitancy.[24]

The study was conducted to explore the predictors of vaccine hesitancy in the NGO charity hospital located in a small village Bathalapalli, Anantapur District, Andhra Pradesh. Out of 574 respondents, 161 mother's children were noted as vaccine-hesitant (refusal = 7; delay = 154) and the prevalence of vaccine hesitancy was found to be 28.05%. The findings of our study are nearly similar to studies conducted in West Bengal (29.26%) and New Delhi (28.90).[22,25] In contrast, a global survey of vaccine hesitancy revealed a 12.5% of prevalence in India.[26] Also, a few studies conducted in Madhya Pradesh (19.7%), Karnataka (3.40%), Chandigarh (10.00), and Odisha (26.54%) revealed a low prevalence rate compared to our study.[27–30] The difference is attributed to variation in design, study site, the questionnaire used, cutoff score, data collection technique, and methodology used in the current study with other studies. Also, the vaccine hesitancy prevalence varies depending on the assessment of individual vaccines

Table 1: Distribution of vaccine hesitancy according to the age of the child (*n*=574)

Vaccines	Delay	Percentage	Refusal or Reluctance	Percentage	No Delay	Percentage
BCG	65	11.3	-	-	509	88.7
OPV	65	11.3	-	-	509	88.7
Hepatitis B birth dose	65	11.3	1	0.2	508	88.5
OPV 1,2 and, 3	94	16.4	-	-	480	83.6
Pentavalent 1,2, and 3	95	16.6	-	-	479	83.4
IPV 1,2,	87	15.1	2	0.3	485	84.5
OPV-B*	6	1.4	-		432	98.6
DPT-B*	7	1.6	-		431	98.4
Measles 1,2*	15	3.4	3	0.6	420	95.9
Rota 1,2, and 3	95	16.6	1	0.2	478	83.3

*Not applicable for children less than 9 months of age, > 9 months (*n*=438)

Table 2: Distribution of reasons for not vaccinating their children

Reason	Frequency (%)
Not possible to leave work	12 (2.09)
Safety of the vaccine	33 (5.75)
Health issues to the baby	67 (11.67)
Distance problem	3 (0.52)
Did not think the vaccine was effective	3 (0.52)
Health care workers were not available	7 (1.21)
The mother went to the parent's home	16 (2.79)
Did not know where to get vaccinated	1 (0.17)
Others	19 (3.31)

or the whole immunization program. In our study, the data was collected from the mother via face-to-face interviews, and vaccine hesitancy was considered to be present in those families who refused, were reluctant, or delayed any of the recommended vaccine doses, as per the age (0–60 months) of the child. Interview mode makes mothers feel comfortable and provides complete information that might cause an increase in the prevalence. The majority of the respondents in our study were illiterate, which may be a reason for their unawareness of vaccinating their children.

The study findings revealed a significant association between joint family and less vaccine hesitancy. In a joint family, all family members support the child to be vaccinated without delay; this results in less vaccine hesitancy. The mother alone takes complete responsibility for the child's vaccination in a nuclear family. Child suffering with a disease, mother busy in a work or caring other child may cause delay of vaccination in nuclear family. Our findings are nearly similar to the results of studies conducted in West Bengal and New Delhi.[22,25] There was a significant association between literacy and vaccine hesitancy. In the current study, mothers with primary and middle-class education levels and illiterates showed high vaccine hesitancy with $P < 0.05$. These findings are parallel with the results of studies conducted in West Bengal, New Delhi, Madya Pradesh, and Chandigarh.[24,25,27,29] Mothers who have lower educational status are unable to remember the vaccination dates and do not understand the importance of immunization. Sometimes, mothers are confused about where to vaccinate their children if they miss a vaccination date of a particular vaccine. The mother's education plays a vital role in understanding the importance of vaccination and the prevention of VPDs.

The current study findings revealed that higher socioeconomic status (upper, upper middle, and lower middle) was significantly associated with low vaccine hesitancy. These categories of mothers can offer vaccination to their children at any nearby healthcare setting. So, this can avoid the delay in vaccination due to long distance and reduce vaccine hesitancy. A study conducted in Madhya Pradesh contrasts our findings that higher socio-economic status s attributed to high vaccine hesitancy.[27] This evidence revealed that higher SES groups might lack confidence in vaccines supplied by the government and make them go to private hospitals, which leads to vaccine hesitancy. Mothers who attended less than four antenatal visits are significantly associated with high vaccine hesitancy. In antenatal care, all mothers are well educated about the importance of the vaccinating their children. Missing antenatal visits make mothers unaware of the importance of vaccination and increase their hesitancy. Similar results are also observed in the study's findings performed in Chandigarh.[29]

The current study revealed that the SAGE working group variables like unawareness, poor access, and unacceptability at individual and community levels were significantly associated with vaccine hesitancy. Similar findings were also observed in the results of the studies conducted in Madhya Pradesh and Odisha.[27,30] In the current study, most mothers were aware that vaccines protect their children and were recommended to take vaccines for their children. But a few were unaware of the importance of vaccination and were reluctant to recommend the vaccine. Still, there is a need to conduct educational campaigns to bring awareness among parents regarding the importance of vaccination and protecting children from VPDs. The accessibility problems addressed by the mothers in the current study can be resolved by additional vaccination camps in villages with no health facilities and by increasing the number of health workers who may visit the areas that are difficult to reach. The vaccine acceptability rate was high among the study participants. Health problems to their child is one of the most common reasons expressed by the mother for vaccine hesitancy. The majority of the mothers said that leaders (healthcare workers, religious leaders, and politicians) in their community supported the vaccination**.** Evidence revealed that a lack of support from religious and political leaders was the primary cause of under-vaccination.[14]

In the current study, the delay was observed in all recommended vaccines, but the refusal or reluctance was seen in only four vaccines (hepatitis B birth dose = 1; IPV 1 and 2 = 2; Measles 1 and 2 = 3; and Rota 1, 2, and 3 = 1). The evidence shows that the pentavalent and measles vaccines were refused in the Odisha study.[30] Vaccine safety is the primary reason expressed by the mothers for refusal of vaccines. Parents are overwhelmed by the large amount of information available on vaccine-induced adverse effects in social networks and the mass media. This leads the parents to refuse vaccine administration for their children. Healthcare staff need to be involved in sensitizing the public regarding adverse events following immunization and reporting suspected events to the

Table 3: Binary logistic regression analysis of parent characteristics associated with vaccine hesitancy

Variable	Total No. (%)	Vaccine Hesitancy No. (%)	Odds Ratio (95% CI)	P
Age of mother				
≤20 years	150 (26.13)	40 (26.67)	0.83 (0.49-1.41)	0.581
21-30	299 (52.09)	83 (27.76)	0.88 (0.56-1.4)	0.662
31-40	125 (21.78)	38 (30.40)	Ref	Ref
Birth order				
First	361 (62.89)	92 (25.48)	0.82 (0.38-1.78)	0.617
Second	179 (31.18)	59 (27.79)	1.18 (0.53-2.63)	0.685
Higher	34 (5.92)	10 (29.41)	Ref	Ref
Age of younger child				
≤ 12 months	323 (56.27)	93 (28.79)	0.93 (0.49-1.76)	0.951
13-24 months	198 (34.49)	52 (26.26)	0.82 (0.42-1.60)	0.682
≥ 25 months	53 (9.23)	16 (30.19)	Ref	Ref
Gender				
Male	300 (52.26)	80 (26.67)	Ref	Ref
Female	274 (47.73)	81 (29.56)	1.15 (0.80-1.66)	0.441
Type of family				
Nuclear	317 (55.23)	101 (31.86)	Ref	Ref
Joint	257 (44.77)	60 (23.35)	0.65 (0.44-0.94)	0.024
Education of mother				
Illiterate	58 (10.10)	29 (50.00)	3.17 (1.50-6.72)	<0.001
Primary	16 (2.79)	12 (75.00)	9.53 (2.71-33.4)	<0.001
Middle	45 (7.84)	19 (42.22)	2.28 (1.01-5.18)	<0.047
High school	171 (29.79)	39 (22.81)	0.93 (0.48-1.80)	0.424
Intermediate or diploma	117 (20.38)	18 (15.38)	0.57 (0.27-1.21)	0.071
Graduate	96 (16.72)	27 (28.12)	1.24 (0.61-2.55)	0.545
Professionals	71 (12.37)	17 (23.94)	Ref	Ref
Education of father				
Illiterate	71 (12.37)	12 (16.90)	0.54 (0.25-1.18)	0.123
Primary	5 (0.87)	5 (100)	30.66 (1.63-575)	<0.001
Middle	27 (4.70)	7 (25.92)	0.93 (0.35-2.49	0.882
High school	150 (26.13)	50 (33.33)	1.30 (0.72-2.34)	0.383
Intermediate or diploma	90 (15.68)	24 (26.67)	0.96 (0.49-1.88)	0.916
Graduate	143 (24.91)	40 (27.97)	1.01 (0.55-1.84)	0.989
Professionals	88 (15.33)	23 (26.14)	Ref	Ref
Location				
Rural	482 (83.97)	139 (28.84)	1.36 (0.75-2.46)	0.309
Semi-urban	21 (3.66)	6 (28.57)	1.35 (0.45-4.05)	0.592
Urban	71 (12.37)	16 (22.53)	Ref	Ref
SES				
I (upper)	34 (5.92)	3 (8.82)	0.09 (0.02-0.36)	<0.001
II (upper middle)	95 (16.55)	27 (28.42)	0.37 (0.15-0.90)	0.023
III (lower middle)	225 (39.19)	65 (28.89)	0.38 (0.16-0.86)	0.015
IV (upper-lower)	193 (33.62)	52 (26.94)	0.34 (0.15-0.79)	0.008
V (lower)	27 (4.70)	14 (51.85)	Ref	Ref
Religion				
Hindus	385 (67.07)	95 (24.67)	0.88 (0.56-1.40)	0.662
Muslims	92 (16.03)	30 (32.61)	0.87 (0.37-2.13)	0.931
Christians	66 (11.50)	25 (37.88)	1.11 (0.45-2.77)	0.830
Others	31 (5.40)	11 (35.48)	Ref	Ref
Distance				
<10 kms	422 (73.52)	117 (27.72)	0.94 (0.62-1.42)	0.850
>10 km	152 (26.48)	44 (28.95)	Ref	Ref
Antenatal visits				
<4	416 (72.47)	134 (32.21)	2.30 (1.45-3.66)	<0.001
≥4	158 (27.52)	27 (17.08)	Ref	Ref

P<0.05 are significant variables

Table 4: Binary logistic regression analysis of SAGE working group variables associated with vaccine hesitancy

SAGE working group variable	Total	Hesitancy	Odds ratio (95% CI)	*P*
Awareness				
Do you think that vaccines can protect your child from serious diseases?				
Yes	563 (98.08)	153 (27.17)	0.14 (0.03-0.53)	0.004
No	11 (1.92)	8 (72.73)	Ref	
Do you think that most parents vaccinate their children against all recommended vaccines?	553 (96.34)	145 (26.22)	0.11 (0.04-0.31)	<0.001
Yes	21 (3.66)	16 (76.19)	Ref	
No				
Accessibility				
Has distance, the timing of hospital, the time needed to get to a hospital or wait at the hospital, and/or costs in getting to the hospital prevented you from getting your child immunized?				
Yes	36 (6.23)	26 (72.22)	7.76 (3.65-16.51)	<0.001
No	538 (93.73)	135 (25.09)	Ref	
Are there other pressures in your life that prevent you from getting your child immunized on time?				
Yes	159 (27.70)	138 (86.8)	1.12 (60.10-20.87)	<0.001
No	415 (72.30)	23 (5.54)	Ref	
Acceptability at the individual level				
Have you ever been reluctant to get a vaccination for your child?				
Yes	11 (1.92)	8 (72.73)	7.15 (1.87-27.29)	0.004
No	563 (98.08)	153 (27.17)	Ref	
Have you ever refused vaccination for your child?				
Yes	6 (1.04)	4 (66.67)	5.23 (0.95-28.87)	0.057
No	568 (98.95)	157 (27.56)	Ref	
Are there any reasons you think that your children should not be vaccinated?				
Yes	160 (27.88)	131 (81.88)	57.82 (33.44-99.97)	<0.001
No	414 (72.50)	30 (7.25)	Ref	
Have you ever received or heard negative information about vaccination?				
Yes	12 (2.09)	8 (66.67)	5.34 (1.58-18.01)	0.007
No	562 (97.90)	153 (27.22)	Ref	
Did you take your child for vaccination even after hearing negative information?				
Yes	572 (99.65)	160 (27.97)	0.38 (0.02-6.25)	0.505
No	2 (0.35)	1 (50.00)	Ref	
Vaccine acceptance at the community level				
Do you think that it is difficult for some ethnic or religious groups in your community/region to get the vaccination for their children?	10 (1.74)	7 (70.00)	6.21 (1.58-24.33)	0.009
Yes	564 (98.25)	154 (27.30)	Ref	
No				
Do leaders (religious, political, teachers, health care workers) in your community support vaccines for infants and children?	572 (99.65)	160 (27.97)	0.39 (0.02-6.25)	0.505
Yes	2 (0.35)	1 (50.00)	Ref	
No				

Pharmacovigilance Program of India (PvPI).[31,32] This will generate evidence on vaccine safety.

Limitations and recommendation

The primary strength of the current study lies in using the WHO–SAGE working group variables that provide a standard comparison of findings with other countries. The majority of the previous Indian studies focused on assessing vaccine hesitancy at the individual vaccine level, whereas our study observed all vaccines present in the universal immunization program. This is the first study conducted in the rural hospital setting of Anantapur district, Andhra Pradesh, India to explore vaccine hesitancy among mothers of under-five children. As this study is hospital-based, our findings cannot be generalized to the community setting. As the study was conducted through face-to-face interviews, it could be subjected to interviewer desirable effects.

Conclusion

The study concludes that the prevalence of vaccine hesitancy (delay and refusal or reluctance) was found to be 28.05%. Demographics like low parent education,

low socioeconomic status, and fewer antenatal visits were significantly associated with vaccine hesitancy. The three dimensions of the WHO–SAGE working group correlated with vaccine hesitancy, providing an opportunity to identify the barriers in awareness, access, and acceptability at individual and community levels. This data helps in developing strategies to improve vaccine coverage. Vaccine safety and the children's health are the main concerns of parents in who refuse or are reluctant of vaccine administration. Sensitization programs on adverse events following immunization and misbeliefs of vaccine administration need to be conducted to reduce vaccine hesitancy. To achieve 100% immunization coverage, policymakers need to resolve vaccine hesitancy present in the public by developing strategies based on demographic and WHO–SAGE working group predictors.

Acknowledgements

All authors would like to thank all participants who are involved in this research study. We also thank Dr Praveen Kumar, Director, RDT Hospital, Anantapur for his support to conduct study in hospital. All the authors are whole heartedly thankful to the people who are directly or indirectly responsible for the completion of the work.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

What is Already Known?

Vaccine hesitancy is one of the top 10 threats to global public health. It can be influenced by awareness, access, and acceptance at the individual and community level.

What this Study Adds?

Identification of demographics and WHO-SAGE working group predictors for the vaccine hesitancy in south Indian rural hospital settings.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Rémy V, Zöllner Y, Heckmann U. Vaccination: The cornerstone of an efficient healthcare system. J Mark Access Health Policy 2015;3:27041.
2. Larson HJ, Cooper LZ, Eskola J, Katz SL, Ratzan S. Addressing the vaccine confidence gap. Lancet 2011;378:526–35.
3. McGovern ME, Canning D. Vaccination and all-cause child mortality from 1985 to 2011: Global evidence from the demographic and health surveys. Am J Epidemiol 2015;182:791–8.
4. Vaccines and immunization. Available from: https://www.who.int/health-topics/vaccines-and-immunization. [Last accessed on 2022 Apr 14].
5. Progress reports. Available from: https://www.gavi.org/programmes-impact/our-impact/progress-reports. [Last accessed on 2022 Apr 14].
6. Ten health issues WHO will tackle this year. Available from: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019. [Last accessed on 2022 Apr 14].
7. Chard AN, Gacic-Dobo M, Diallo MS, Sodha SV, Wallace AS. Routine vaccination coverage — Worldwide, 2019. MMWR Morb Mortal Wkly Rep 2020;69:1706–10.
8. Organization W | WH. WHO | Immunization Country Profile. Available from: https://apps.who.int/immunization_monitoring/globalsummary/countries?countrycriteria%5Bcountry%5D%5B%5D=IND&commit=OK. [Last accessed on 2022 Apr 15].
9. Shenton LM, Wagner AL, Bettampadi D, Masters NB, Carlson BF, Boulton ML. Factors Associated with Vaccination Status of Children Aged 12–48 Months in India, 2012–2013. Matern Child Health J 2018;22:419–28.
10. National Family Health Survey. Available from: http://rchiips.org/nfhs/factsheet_nfhs-4.shtml. [Last accessed on 2022 Apr 15].
11. Singh S, Sahu D, Agrawal A, Vashi MD. Ensuring childhood vaccination among slums dwellers under the National Immunization Program in India - Challenges and opportunities. Prev Med 2018;112:54–60.
12. Gurnani V, Haldar P, Aggarwal MK, Das MK, Chauhan A, Murray J, *et al*. Improving vaccination coverage in India: Lessons from Intensified Mission Indradhanush, a cross-sectoral systems strengthening strategy. BMJ 2018;363:k4782.
13. Larson HJ, Jarrett C, Eckersberger E, Smith DMD, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007-2012. Vaccine 2014;32:2150–9.
14. MacDonald NE, SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. Vaccine 2015;33:4161–4.
15. World Health Organization: Draft thirteenth general programme of work 2019–2023;46.
16. Koïvogui A, Carbunar A, Imounga L-M, Laruade C, Laube S. Vaccination against yellow fever in French Guiana: The impact of educational level, negative beliefs and attitude towards vaccination. Travel Med Infect Dis 2017;15:37–44.
17. World Health Organization. Report of the SAGE Working Group on Vaccine Hesitancy. Available from: https://www.who.int/immunization/sage/meetings/2014/october/1_Report_WORKING_GROUP_vaccine_hesitancy_final.pdf. [Last accessed on 2022 Apr 15].
18. Gust DA, Kennedy A, Shui I, Smith PJ, Nowak G, Pickering LK. Parent attitudes toward immunizations and healthcare providers the role of information. Am J Prev Med 2005;29:105–12.
19. Opel DJ, Mangione-Smith R, Taylor JA, Korfiatis C, Wiese C, Catz S, *et al*. Development of a survey to identify vaccine-hesitant parents: The parent attitudes about childhood vaccines survey. Hum Vaccin 2011;7:419–25.
20. Larson HJ. Negotiating vaccine acceptance in an era of reluctance. Hum Vaccin Immunother 2013;9:1779–81.
21. Summary-of-sage-vaccinehesitancy-en.pdf. Available from: https://cdn.who.int/media/docs/default-source/immunization/demand/summary-of-sage-vaccine

hesitancy-en.pdf?sfvrsn=abbfd5c8_2. [Last accessed on 2022 Apr 15].
22. Cherian V, Saini NK, Sharma AK, Philip J. Prevalence and predictors of vaccine hesitancy in an urbanized agglomeration of New Delhi, India. J Public Health 2022;44:70–6.
23. Patel MK, Orenstein WA. Classification of global measles cases in 2013-17 as due to policy or vaccination failure: A retrospective review of global surveillance data. Lancet Glob Health 2019;7:e313–20.
24. Lane S, MacDonald NE, Marti M, Dumolard L. Vaccine hesitancy around the globe: Analysis of three years of WHO/UNICEF Joint Reporting Form data-2015-2017. Vaccine 2018;36:3861–7.
25. Sikder R, Mukherjee D, Pattanayak U, Majumdar KK, Kundu SS, Dey R, *et al*. Prevalence of vaccine hesitancy and its associated factors in an urban area of West Bengal, India. Int J Community Med Public Health 2020;7:3443.
26. Larson HJ, Schulz WS, Tucker JD, Smith DMD. Measuring vaccine confidence: Introducing a global vaccine confidence index. PLoS Curr 2015;7:ecurrents.outbreaks.ce0f6177bc97332602a8e3fe7d7f7cc4.
27. Agarwal AK, Sengar A, Gupta P, Gupta R. A study of vaccine hesitancy among mother and care provider during mr vaccine campaign. Natl J Community Med 2019;10:605–11.
28. Thapar R, Kumar N, Surendran P, Shahdiya A, Mahendran V, Ramesh R, *et al*. Vaccine hesitancy among mothers of under-five children in Coastal South India: A facility-based cross-sectional study. F1000Res 2021;10:186.
29. Wagner AL, Shotwell AR, Boulton ML, Carlson BF, Mathew JL. Demographics of Vaccine Hesitancy in Chandigarh, India. Front Med 2021;7:585579.
30. Sharma S, Akhtar F, Singh RK, Mehra S. Understanding the three As (Awareness, Access, and Acceptability) dimensions of vaccine hesitancy in Odisha, India. Clin Epidemiology Glob Health 2020;8:399–403.
31. Nair G, Venkatesan K, Nair A, Firoz IN, Haroon NN. COVID-19 vaccine hesitancy and influence of professional medical guidance. J Edu Health Promot 2022;11:112.
32. Khan Z, Khursheed SQ, Dar SA, Shah NN, Reagu S, Alabdulla M, *et al*. Vaccine hesitancy and coronavirus disease-19: Where do we stand?. J Edu Health Promot 2022;11:59.