

Factors related to vaccine hesitancy during the implementation of Measles-Rubella campaign 2017 in rural Puducherry-A mixed-method study

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ABSTRACT

Background: Measles is one the leading cause of morbidity, mortality, and disability among under-five children worldwide with India contributing to half of the burden. Hence, Measles-Rubella (MR) campaign was launched to vaccinate all the children between 9 months and 15 years. The current study was done to find the prevalence and factors related to vaccine hesitancy in the MR campaign 2017 in rural Puducherry. **Methods:** This was a mixed-method study conducted with a quantitative part involving cross-sectional survey done among parents of children aged between 9 months and 15 years to determine the proportion of MR vaccine hesitancy and qualitative part involved in-depth interviews to explore the barriers and facilitating factors for the MR vaccine hesitancy. **Results:** Among 461 participants, the prevalence of vaccine hesitancy for the MR campaign was 14.1% (95%CI: 11-17.6%). In adjusted analysis, only mother's age (aPR-2.27) was the significant predictor of vaccine hesitancy. In qualitative analysis, major facilitating factor for campaign was the role played by the doctors in spreading awareness regarding the importance of vaccine and trust by parents on doctors. Major hindering factors were inadequate knowledge regarding campaign, rumors spread about the safety of vaccine, sudden planning, and under preparedness at health system level. **Conclusion:** The current study found that almost one-fifth of the parents were hesitant to give vaccination to children. Social media rumors, lack of knowledge among parents, and inadequate time in planning were major reasons for vaccine hesitancy. Hence, countries should undertake training and education of healthcare workers to empower them to address the vaccine hesitancy.

Keywords: Measles vaccine, qualitative research, Rubella vaccine

Introduction

Measles is one of the leading cause of childhood death and disability among children worldwide. Around 1.3 lakhs children developed measles in 2016 and an estimated 90,000 deaths were

reported.^[1] India contributes to more than half of these deaths as around 49,000 deaths occurred in India.^[2] Although there was a significant reduction in the mortality rate in India when compared to the last decade, it needs to be accelerated further to achieve the measles elimination goal 2020. Congenital rubella syndrome is another disorder that was targeted to be controlled by the year 2020 as it is responsible for irreversible birth defects such as blindness and deafness in about 40,000 children every year.^[2] The major obstacle in achieving this target is the vaccination coverage against measles, which is around 80% lesser than the elimination

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target of 95%. Hence, 11 member states in the southeast Asian region including India committed to eliminate the measles and control rubella by 2020.^[2]

To achieve this goal, Ministry of Health and Family Welfare (MoHFW) has launched a campaign called Measles-Rubella (MR) campaign in phased manner in February 6, 2017 to vaccinate all the children between 9 months and 15 years. The campaign targeted around 41 crore children across India.^[3] All the children were vaccinated irrespective of their previous vaccination status. Routine doses were given separately according to the national immunization schedule. The first phase of the campaign was launched in five states namely Goa, Lakshadweep, Karnataka, Puducherry, and Tamil Nadu.^[3] However, even before the campaign started, several rumors regarding the safety of vaccines were circulated on social media, which led to confusion among the parents. Minor adverse events following immunization (AEFI) were magnified disproportionately by social media leading to panic among some of the parents of children and increased vaccine hesitancy.

Vaccine hesitancy can be defined as the delay in acceptance or refusal of a safer vaccine in spite the availability of services for vaccination.^[4] Vaccine hesitancy and refusal should be dealt as an important issue as it carries both individual and community level risks. World Health Organization has announced vaccine hesitancy as one of the top ten threats to global health in 2019.^[5] Population with more vaccine hesitancy has more chance of contracting and spreading the vaccine-preventable diseases as well as more number of outbreaks in the community.^[6] A retrospective cohort study in United States using the country wide surveillance data showed that the risk of contracting the measles infection was almost 35 times higher among children whose parents had exempted from vaccination than the vaccinated children.^[7] It is a complex phenomenon that varies across the place, time, and vaccines. However, there was no proper assessment on the extent of this vaccine hesitancy toward the MR in any of the states involved in the first phase of the campaign. This assessment will help in finding out the extent and reason for vaccine hesitancy and further help in better planning in any future vaccination campaign. Hence, the current study was done to find the prevalence and factors related to vaccine hesitancy and explore the reasons behind the hesitancy in the MR campaign 2017 in rural Puducherry.

Methods

This was a sequential explanatory mixed-method study following descriptive theoretical underpinning. The quantitative part involved a cross-sectional survey done among parents of children aged between 9 months and 15 years to determine the proportion of MR vaccine hesitancy. The qualitative part involved an in-depth interview among parents of children aged between 9 months and 15 years followed by key informant interview of health workers involved in providing immunization services in the rural health center of a tertiary care institute in Puducherry.

Phase I: Quantitative (Cross-sectional survey)

Study setting and period

A community-based mixed-method study was carried out among parents of children aged between 9 months and 15 years residing in the JIPMER rural health centre (JIRHC) service area, Puducherry. JIRHC caters to a population of around 10,000 spread over four villages viz. Ramanathapuram, Thondamanatham, Pillaiyarkuppam, and Thuthipet. The study was conducted during the month of January and February 2018.

Sample size and sampling technique

The sample size was calculated by OpenEpi 3.01 (updated on 2013, USA) using the anticipated proportion of MR vaccine hesitancy 30% obtained from the reports submitted during the campaign conducted in February 2017, with absolute precision of 5% and 95% confidence interval. The sample size was estimated to be 323. To adjust for clustering within the villages, the design effect of 1.5 was used and final sample size was arrived at 484.

The primary sampling unit was households. Numbers of households needed from each of the four villages were calculated using proportionate sampling after which, systematic random sampling was employed to select the households from the villages. Parents of children belonging to the age group between 9 months and 15 years were the study unit and recruited into the study from the selected households.

Data collection and study procedure

Six training doctors posted in rural health center were chosen as data collectors. The purpose of the study and procedure involved in the study was explained to the individuals before the administration of the questionnaire. Individuals were also assured regarding the confidentiality of the information, and data collection were started after obtaining informed consent. Information on socio-demographic variables was collected using a pre-tested semi-structured questionnaire, and WHO SAGE Vaccine hesitancy survey tool was administered after making necessary modification for assessing the various reasons pertaining to MR vaccine hesitancy. Questionnaire was regarding parent's perception toward MR vaccine, hindrance related to access to point of delivery for MR vaccine, members involved in motivation for accepting MR vaccination after initial hesitation, and various reasons for MR vaccine hesitancy using 5-point Likert scale.

Phase II: Qualitative (In-depth interview and Key informant interview)

An in-depth interview was conducted among six vocal and willing parents at the place of their convenience. Two parents who were found to be refused to MR vaccine, two parents who initially hesitated and accepted after motivation from a health worker, and two parents who gave vaccination without any hesitation were purposively selected for the interview. Parents who refused

MR vaccine interviewed to explore more on barrier factors, and parents who accepted after initial hesitancy were interviewed to explore the reason for accepting the vaccination even after initial hesitancy. Parents who gave vaccination without any hesitation were interviewed to find the facilitating factors in the campaign. None of the approached parents refused to participate in the study. All six participants were interviewed using a pre-tested semi-structured interview guide. Demographic details of the participants were two middle-aged mothers (MAMs) who refused MR vaccine, two middle-aged fathers (MAFs) who accepted after initial hesitancy for MR vaccine, and one MAF and one MAM who accepted without hesitation.

Following which four key informant face-to-face interviews were conducted with the vocal and willing health care workers who were selected purposively. Two female senior nursing officers, one male medical officer, and one Auxiliary Nurse Midwife (ANM) who were providing immunization service in the rural health center were selected for the interview. The interviewer was the principal investigator who conducted all the in-depth interviews. All the interviews were conducted within the premises of the rural health center at the end of the well-baby clinic. Participants were interviewed regarding their perception on hesitancy toward the MR vaccine campaign and asked to give suggestions and solutions to improve the vaccine acceptancy.

The interviewer was the principal investigator, a female postgraduate student in a tertiary care institute who was fluent in the local language. The interviewer was formally trained in a qualitative research workshop and also has previous experience in qualitative research. The interview was started after obtaining consent and explaining the purpose and motive of the study. The privacy of the information was ensured by conducting the interview in an isolated room without the presence of any non-participants. Participants were ensured confidentiality of the information obtained through the interview. All the interviews were audio-recorded with consent. Each interview took around 15–30 min. Field notes were taken during the interview. At the end of the interview, a summary was presented to the parents for validation of the data collected. Transcription was done using verbatim format within 2 days of data collection to prevent the loss of information.

Analysis

Quantitative

Data were entered into Epidata v 3.01 software (Manufactured by Epidata association on year 1999 in Denmark), and analysis was done using SPSS version 19.0 continuous variables such as age were summarized as mean (SD). The prevalence of vaccine hesitancy was summarized as proportion with 95% confidence interval. Bivariate analysis (Chi-square test/Fisher exact test) was used to find the association between socio-demographic factors and MR vaccine hesitancy. Factors significant at *P* value less than 0.10 in the bivariate analysis were included in the multivariate analysis. Multiple logistic regression was chosen for

multivariate analysis as the prevalence of vaccine hesitancy was only around 10%, and hence, the odds ratio could be equated with the prevalence ratio. Vaccine hesitancy was considered as dependent variable and age of the mothers, educational qualification of mother and father, and occupation of the mother were considered as explanatory variables. The final model in multiple logistic regression was chosen according to adjusted R-square value. The effect of clustering at the level of villages on vaccine hesitancy was evaluated using the random-intercept model. Likelihood ratio test (LR test) which compared this model with the naïve model (final model in multiple logistic regression) showed a significant *P* value (<0.001), depicting a significant effect of clustering at village level on vaccine hesitancy. Intra-class correlation coefficient (showing between cluster variability) was found to be 0.146. Hence, the multivariate analysis was analyzed according to random-intercept model and reported as adjusted Odds ratio (aOR) ratio with 95% confidence interval.

Qualitative

Collected data were transcribed in verbatim format. Participant's statements were taken as a unit of analysis. The coding was done at the beginning of the study by a deductive method but with the advancement of the research and identification of the contents; inductive approach for the review was also used. Descriptive manual content analysis was done to derive the categories and codes. Data collected were validated by the principal investigator. These were reviewed by another investigator to reduce subjective interpretation. Constant comparative analysis was done to ensure the credibility and reliability of the data. Study was reported in accordance to the consolidated criteria for reporting qualitative research (COREQ).^[8]

Results

Quantitative part

In total, 484 parents of children aged between 9 months and 15 years in the study setting were contacted to participate in the study. Out of which, 461 (95.2% response rate) responded completely to the questionnaire. Twenty-three individuals did not give consent to participate in the study.

Socio-demographic characteristics of the study participants were described in Table 1. More than one-third of children (41.0%) were between 9 months and 5 years of age. More than half of children (56.2%) were females. Majority of the father of children (77.2%) were above 31 to 45 years of age; Two-third of them (61.6%) were educated between 1 and 10 years of schooling and almost all of them (98.9%) were employed. More than half (52.1%) of the mother of children were above 31 to 45 years of age; Two-third of them (62.1%) were educated between 1 and 10 years of schooling, and majority of them 383 (83.1%) were unemployed. Majority of them (96.7%) were Hindu by religion; two-third of them (65.9%) belonged to nuclear family, and more than two-third of them (68.5%) were belonging to below poverty line.

Table 1: Sociodemographic characteristics of the study participants, n=461

Sociodemographic characteristics	Frequency, n (%)
Age of the child in category (in years)	
9 months-5 years	189 (41.0)
6-10	177 (38.4)
11-15	95 (20.6)
Age of the father in category (in years)	
21-30	66 (14.3)
31-45	354 (76.7)
≥46	41 (9.0)
Age of the mother in category (in years)	
21-30	214 (46.4)
31-45	240 (52.1)
≥46	7 (1.5)
Gender of the child	
Male	259 (56.2)
Female	202 (43.8)
Father's Education (years of schooling)	
No formal education	14 (3.0)
1-10	286 (62.0)
11 and above	161 (35.0)
Mother's Education (years of schooling)	
1-10	300 (65.0)
11 and above	161 (35.0)
Father's Occupation	
Unemployed	5 (1.1)
Employed	456 (98.9)
Mother's Occupation	
*Unemployed	383 (83.1)
Employed	78 (16.9)
Religion	
Hindu	446 (96.7)
Christian	15 (3.3)
Family type	
Nuclear	304 (65.9)
Joint	133 (28.8)
Three generation	24 (5.2)
Type of ration card	
Red (Below poverty line)	316 (68.5)
Yellow (Above poverty line)	132 (28.6)
Not available	13 (5.2)

*Includes homemaker, pensioner and students

The prevalence of vaccine hesitancy for the MR campaign in rural Puducherry was found to be 14.1% (95% CI: 11-17.6%). Out of which, only 6 (1.3%) parents refused to give vaccination during the campaign. Table 2 shows the association of socio-demographic characteristics with vaccine hesitancy. It was found that mothers more than 30 years of age were 2.65 times more prevalent to have vaccine hesitancy when compared to younger mothers less than 30 years of age, and it was found to be statistically significant ($P < 0.001$). In addition, employed mothers were more prevalent (OR – 2.34, $P < 0.001$) to have vaccine hesitancy when compared to unemployed mothers. Educational qualification of both mothers and fathers were found to influence the vaccine hesitancy. When compared to fathers who were graduates, fathers with lesser educational

qualification between primary and secondary education were more prevalent (OR – 1.83, $P = 0.03$) to have vaccine hesitancy. Similarly, mothers who have primary to secondary education were more prevalent (OR – 1.79 $P = 0.04$) to have vaccine hesitancy when compared to graduate mothers. Predictors of vaccine hesitancy were represented in Table 3. After adjusted for other variables and clustering between the villages using the random intercept model, only mother's age (aOR – 2.27 $P = 0.01$) was found to be the significant predictor of vaccine hesitancy in rural Puducherry.

Qualitative part

Predetermined themes such as the facilitating factors in the implementation of MR vaccination campaign and reasons for hesitating/refusing to vaccinate their children during the campaign and suggestions and solutions to reduce the hesitancy in vaccination for any new campaign in the future were generated through the deductive approach. Each of the themes was categorized into parent level, school level, community level, and health system level.

Figure 1 depicts the facilitating factors in the implementation of MR vaccination campaign. It was perceived by most respondents that they felt the vaccine protects the children from serious diseases. A major role was played by the doctors in facilitating the campaign by spreading awareness regarding the importance of vaccine and trust by the parents on doctors. One MAM mentioned that as most of the neighbors vaccinated their children, they also perceived that the vaccine is safe.

“Vaccinating will protect my children from developing serious diseases” (MAM) and (MAF)

“I trust the advice given by my doctor and since he told that the vaccinating our child is important, I vaccinated my child” (MAF)

“Most of my neighbors gave vaccine to their children. So we also thought that the vaccine is safe and gave to our child” (MAF)

Figure 2 depicts the reasons for hesitating/refusing to vaccinate the children during the MR campaign. The major reason quoted by almost all the respondents for vaccine hesitancy was the rumors spread about the safety of the vaccine. One MAM told that the schools asked for written willingness to give the vaccine to the children which made them hesitant. From the health system perspective, one senior nursing officer (SNO) has mentioned that there was lack of time in preparation for a campaign, which leads to lesser awareness sessions with the general public.

“We received messages saying that the vaccine will have serious side effects and not to give it. So we were afraid to give it our children” (MAF)

“My daughter's school called for parent-teachers meeting just before the campaign; they told us to give written willingness to give the vaccine to our

Table 2: Factors associated with MR vaccine hesitancy among the parents of children aged between 9 months and 15 years in rural Puducherry, South India (n=461)

Characteristics	n	Vaccine hesitancy present n (%)	Vaccine hesitancy absent n (%)	Unadjusted Odds ratio (95% CI)	P
Age of the child in category (in years)					
9 months-5 years	189	25 (13.2)	164 (86.7)	1.00 (Ref)	-
6-10	177	24 (13.6)	153 (86.4)	1.02 (0.61-1.72)	0.926
11-15	95	16 (16.8)	79 (83.2)	1.27 (0.71-2.26)	0.412
Age of the father in category (in years)					
≤30	66	8 (12.1)	58 (87.9)	1.00 (Ref)	-
>30	395	57 (14.4)	338 (85.6)	1.19 (0.59-2.38)	0.622
Age of the mother in category (in years)					
≤30	214	16 (7.5)	198 (92.5)	1.00 (Ref)	-
>30	247	49 (19.8)	198 (80.2)	2.65 (1.55-4.52)	<0.001*
Gender of child					
Male	259	40 (15.4)	219 (84.6)	1.00 (Ref)	-
Female	202	25 (12.4)	177 (87.6)	0.80 (0.50-1.27)	0.350
Father's educational qualification (years of schooling)					
No formal education	14	1 (7.1)	13 (92.9)	0.76 (0.11-5.38)	0.789
1-10	286	49 (17.1)	237 (82.9)	1.83 (1.07-3.17)	0.029*
11 and above	161	15 (9.3)	146 (90.7)	1.00 (Ref)	-
Mother's educational qualification (years of schooling)					
1-10	300	50 (16.7)	250 (83.3)	1.79 (1.04-3.08)	0.036*
11 and above	161	15 (9.3)	146 (90.7)	1.00 (Ref)	-
Mother's occupation [#]					
Unemployed	383	44 (11.5)	339 (88.5)	1.00 (Ref)	-
Employed	78	21 (26.9)	57 (73.1)	2.34 (1.48-3.71)	<0.001
Family type					
Nuclear	304	45 (14.8)	259 (85.2)	1.00 (Ref)	-
Joint	133	17 (12.8)	116 (87.2)	0.86 (0.51-1.45)	0.580
Three Generation	24	3 (12.5)	21 (87.5)	0.84 (0.28-2.51)	0.762

Ref - Reference value, *P value statistically significant, [#]includes homemaker, pensioner and students

Table 3: Predictors of vaccine hesitancy among the parents of children aged between 9 months and 15 years in rural Puducherry, South India (n=461)

Characteristics	n	Vaccine hesitancy n (%)	Adjusted Odds ratio (95% CI)	P
Age of the mother in category (in years)				
≤30	214	16 (7.5)	1.00 (Ref)	-
>30	247	49 (19.8)	2.27 (1.21-4.27)	0.01*
Father's educational qualification (years of schooling)				
No formal education	14	1 (7.1)	0.45 (0.07-3.75)	0.468
1-10	286	49 (17.1)	1.00 (Ref)	-
11 and above	161	15 (9.3)	0.75 (0.36-1.58)	0.451
Mother's educational qualification (years of schooling)				
1-10	300	50 (16.7)	1.70 (0.80-3.60)	0.162
11 and above	161	15 (9.3)	1.00 (Ref)	-
Mother's occupation				
Unemployed [#]	383	44 (11.5)	1.00 (Ref)	-
Employed	78	21 (26.9)	1.84 (0.95-3.56)	0.07

Ref - Reference value, *P value statistically significant, [#]includes homemaker, pensioner, and students

children saying that the school authority is not responsible for any side effects due to vaccine” (MAM)

“We were not given enough time to plan for the campaign-related activities like discussion with schools, community members; we were informed just a month before that such campaign is going to happen; so we faced some challenges during the campaign” (, SNO)

Figure 3 enumerates the suggestions and solutions to overcome the hindering factors in implementing any future large scale vaccination campaign. One of the common suggestions by all the health care workers was to plan and inform about the campaign in advance which might help in the preparation of activities. Another common suggestion was to create awareness through rigorous IEC activities about

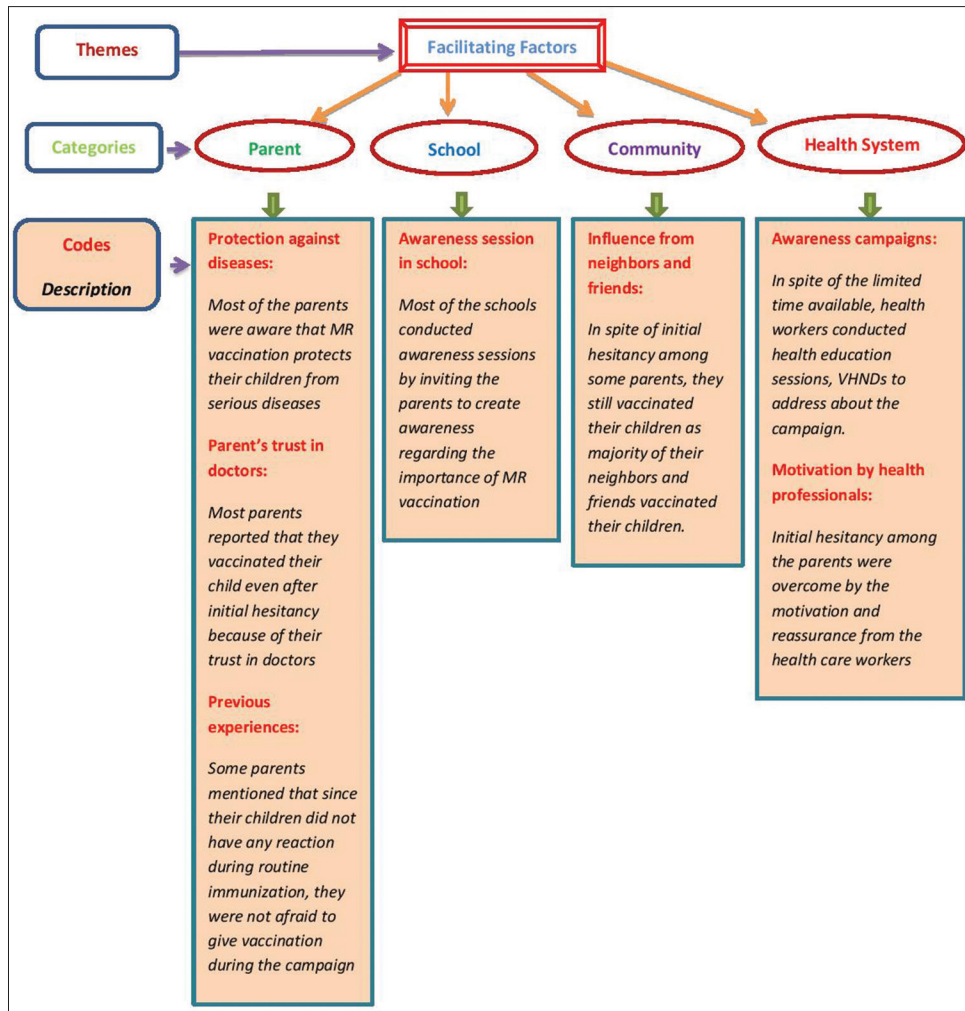


Figure 1: Facilitating factors in the implementation of MR vaccination campaign

the importance of vaccinating the children and the need for that extra dose if the vaccine is already in the routine immunization schedule.

“Informing about the campaign in advance will give us more time in creating awareness about the importance of vaccine through routine home visits, VHNDs and special health education sessions” (ANM)

“IEC activities should be done more frequently and should address the need, safety and eligibility for the vaccine. This will reduce the confusion and hesitancy among the parents and will increase the coverage” (SNO)

Discussion

This was a community-based mixed-method study conducted among parents of children between 9 months and 15 years to identify the factors related to vaccine hesitancy during the MR campaign 2017. The prevalence of vaccine hesitancy for MR campaign in rural Puducherry was found to be 14.1%. Unadjusted analysis showed that factors such as age of the mother, educational qualification of mother, and father and

mother’s occupation were associated with vaccine hesitancy. After adjusted analysis, age of the mother was found to be the only predictor of vaccine hesitancy.

We could not find any study focusing on MR vaccine hesitancy. However, studies around the world on vaccine hesitancy, in general, showed prevalence ranging from 8% to 15%.^[9-11] This prevalence was similar to the current study finding showing that almost one-fifth of the parents were hesitant to give vaccination to their children. This result necessitates the importance of exploring the reasons for hesitancy and finding the corrective measures as our country is focusing toward achieving universal immunization coverage.

Hence, qualitative interviews were conducted following the survey to find the barriers and solutions at the parents, school, community, and health system level. At the parent level, inadequate knowledge regarding the importance and eligibility for the vaccination was reported to be the major reason for hesitancy. However, most parents mentioned that they overcame this barrier and vaccinated their children because of their trust in the doctors and health care workers.

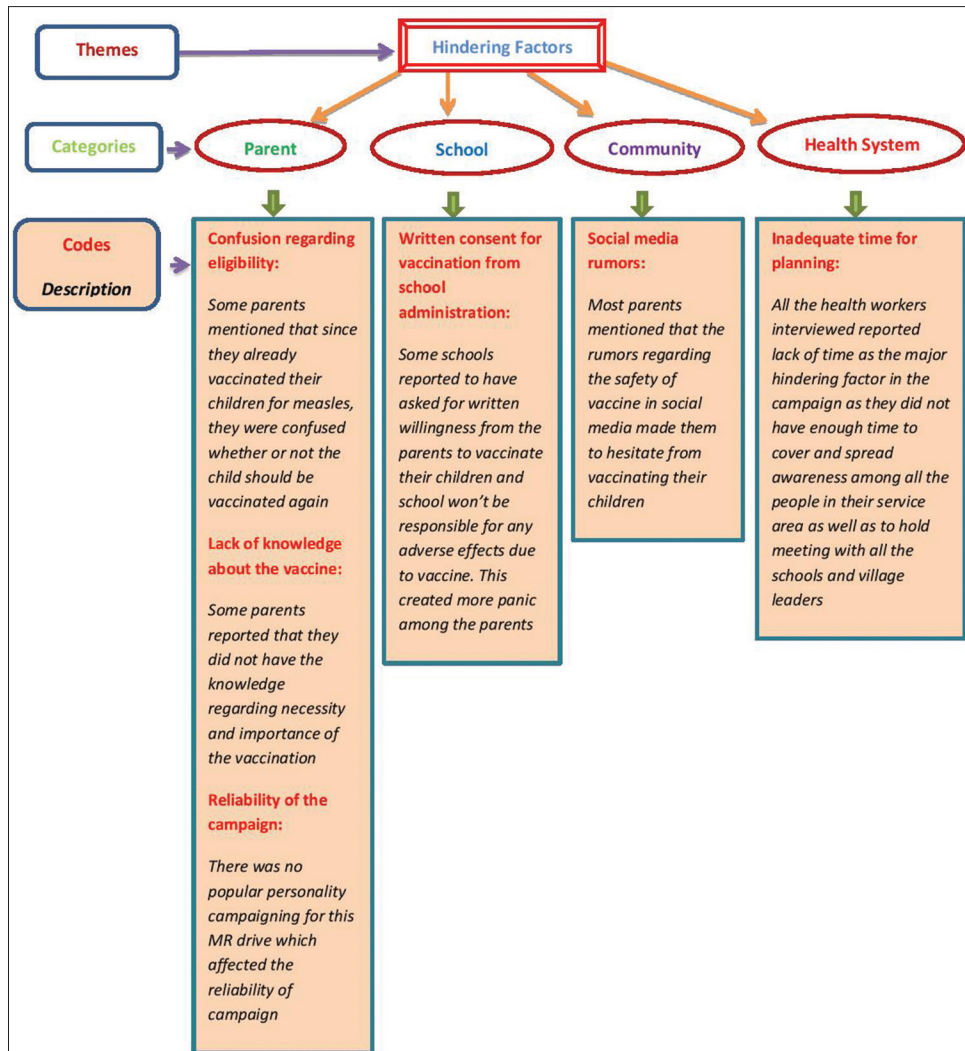


Figure 2: Reasons for hesitating/refusing to vaccinate the children during the MR campaign

Schools played an important role in the promotion of the campaign by conducting awareness sessions and addressing about the vaccination campaign during parent teacher’s meeting. However, some schools created panic by asking for written willingness from the parents to vaccinate their children and that the school administration holds no responsibility in the event of any adverse reaction. Although this made some of the parents to hesitate in giving vaccine, it was later overcome with the help of health care workers.

For the community-level factors, all the parents and health workers interviewed reported that the major reason for the hesitancy was the rumors spread regarding the safety of the vaccine through social media. They have mentioned that the message was circulated with friends, relatives, and other community domains without confirming the authenticity of the information. However, repeated awareness sessions through various mass media channels have helped to overcome these barriers.

Health workers have mentioned that sudden planning and under-preparedness at the health system level was one of the

major barriers in the successful implementation of the campaign. However, in spite of the limited time availability, health workers from the grass-root level to the program managers have made several efforts such as conducting meetings with the leaders, community members, and regular mass media campaigns to reduce the spread of rumors.

Although efforts at all this level have ensured that 65 parents were hesitant initially to give vaccination, only 6 refused to vaccinate their children at the end of campaign. However, it is important to find the reasons and convince these 6 parents also to achieve the target of universal immunization. Parents who refused the vaccine has mentioned that they do not believe that the vaccine protect their children from any disease but only cause serious side effects. Hence, they were told regarding the disease burden, safety of the vaccine, and chance of serious adverse reaction among vaccinated children in detail.

Adoption of mixed-method design was the major strength of the study as it helped in exploring the reasons for hesitancy and suggestions to overcome it. Adjusting for the clustering effect at

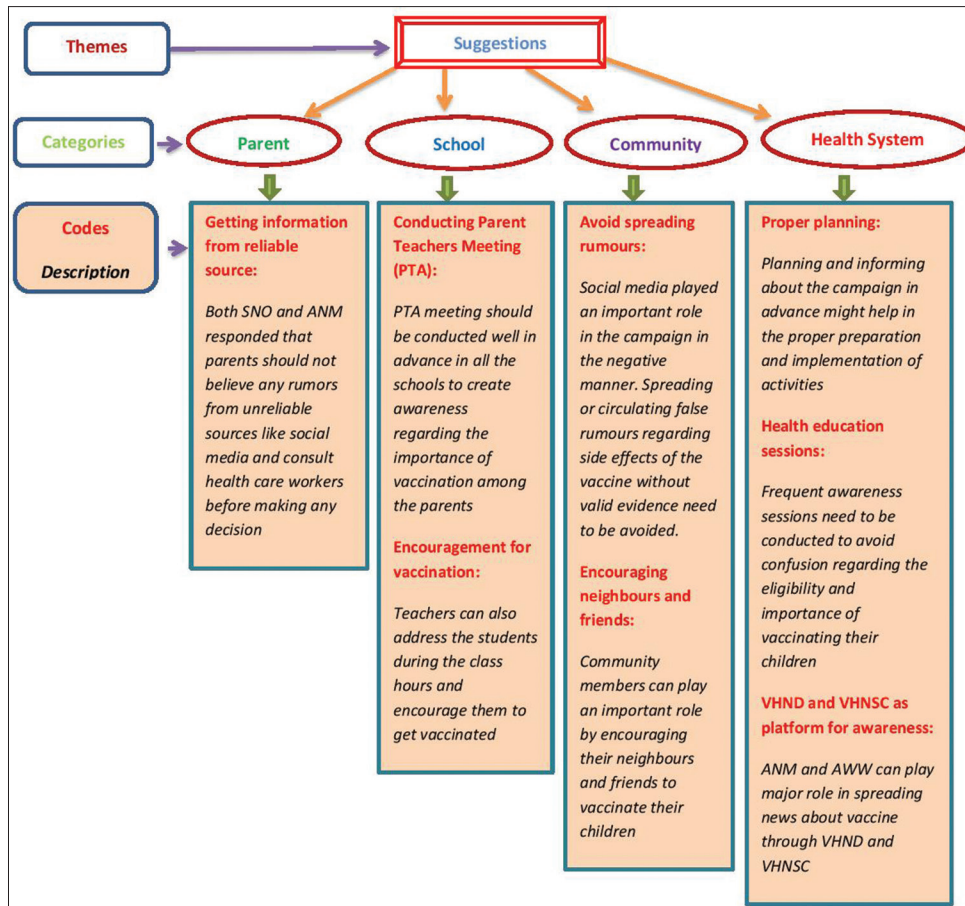


Figure 3: Suggestions and solutions to overcome the hindering factors in implementing any future large scale vaccination campaign

the study design and analysis level were added strengths to the study. Community-based nature of the study and higher response rate can increase the generalizability of the study results. In spite of these strengths, there were certain limitations also. In addition to four levels covered in the interview, addressing more levels such as religion, cultural, political, and geographical barriers from the relevant stakeholders and leaders would have provided much more insight into the hesitancy during the campaign. Since, this was a cross-sectional survey, causality of association cannot be determined.

This study has several programmatic implications. Our study found some interesting findings related to facilitating factors and barriers in vaccine acceptance. One of the important factors facilitating vaccine acceptance was the trust in primary care physicians. This finding was supported by previous evidences addressing vaccine hesitancy.^[12,13] They remain a trusted source of health information and help in overcoming the fear of hesitant parents. Hence, family physicians and primary healthcare providers have an important role in counseling the vaccine-hesitant parents and establish confidence in them.

Creating a vaccine safety system with an effective communication approach will address the vaccine concerns and help in maintaining public confidence. For a vaccination campaign, better planning, participation, and collaborative effort between various ministries

and technology sectors, public health professionals, pediatricians, family practice, and primary care physicians as well as community members might help in its successful implementation.^[14] However, further surveillance on trends in vaccine hesitancy can be done as it will provide further valuable insights on the interventions that might work to reduce the hesitancy level and help in the immunization of all the children in the country.

Conclusion

Current study found that almost one-fifth of the parents were hesitant to give vaccination to their children. Social media rumors, lack of knowledge about the vaccine, and inadequate time in planning were found to be the major reasons for vaccine hesitancy. Trust in the doctors and motivation by primary care providers were the major reason for vaccine uptake after initial hesitancy. Hence, countries should undertake training and education of family physicians and primary care workers to empower them to address the issues regarding vaccine hesitancy as well as addressing the vaccine-hesitant behaviors among the health workers.

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Conflict of interest

There is no conflict of interest.

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