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Parental Beliefs, Vaccine Hesitancy, and Refusal Factors Toward Routine Childhood Vaccination in Sana'a City, Yemen: A Cross-Sectional Study

Abol Gaith[1]
Sana'a University
Nabil Ahmed
Sana'a University
Ghaida'a Hafedh
ghaidaibrahim1997@gmail.com
Al-Razi University
Aisha Faisal
Lecturer of Public Health, Al-Razi University
Ahmed Hamood Al-Shahethi
Al-Razi University

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Abstract

Background

Childhood immunization is one of the most successful public health measures for preventing infectious diseases and ensuring low morbidity and mortality rates among children. Although there is evidence to suggest that Yemen enjoys relatively high immunization coverage, parental hesitancy and resistance towards vaccines still represent key issues, especially in crisis-stricken areas such as Sana'a city. This study aim to assess parental Beliefs, Vaccine Hesitancy, and Refusal Factors Toward Routine Childhood Vaccination in Sana'a City, Yemen: A Cross-Sectional Study.

Methods: A cross-sectional analysis study was carried out from October 2021 to March 2022

in four public hospitals in the Sana'a city. In total, 467 Yemeni parents ≥ 18 years old were selected from the above-listed hospitals by applying a hospital-based sampling method. Data collection was done through a structured and pre-tested questionnaire that involved sociodemographic variables, vaccination, parental beliefs and attitudes, and reasons for hesitance and refusal to vaccinate their children. Data analysis was done using the SPSS program.

Results: Of all the study respondents, 58.7% were males and 61.5% were between the ages of 19 to 35 years. In terms of the completion rate of the routine childhood vaccinations, 71.9% of the respondents confirmed that they completed their child's vaccination process, but 15.8% of the respondents confirmed that they have not even vaccinated their children once in their lifetime. 59.7% of the respondents were not hesitant to vaccinate their children. It was observed that the parents had confidence in the healthcare providers for getting information related to vaccines (80.7%).

Conclusion:

Despite the high level of vaccination of children in the city of Sana'a, there still exists a percentage of parents who are reluctant to vaccinate their children. Safety concerns and misinformation about vaccines act as critical deterrents for proper vaccine uptake. Communication training for health care workers and context-specific methods must be put in place.

Background

Vaccines remain one of the most efficient ways to reduce mortality by preventing vaccine-preventable infections among children; every year up to five million people die due to vaccine-preventable diseases like measles, diphtheria, pertussis and tetanus [1, 2]. Although highly efficient and cost-effective, immunization programs still suffer from underutilization of routine immunization coverage in low- and middle-income countries, where the healthcare systems are underdeveloped, and access to health services varies greatly [3, 4]. Gaps in immunization coverage may lead to outbreaks of vaccine-preventable infections, which can be avoided with appropriate vaccine introduction [5].

Recently, vaccine hesitancy (vaccination delay or refusal despite availability of services), defined as the concept by WHO Strategic Advisory Group of Experts (SAGE) on Immunization, became a major issue for immunization programs around the world [6]. Hesitancy about immunization is highly context-based and related to the particular time period, place, and type of vaccines. This complex phenomenon depends on multiple factors associated with three main concepts: confidence, complacency, and convenience [6]. In recognition of the growing importance of the problem, WHO listed vaccine hesitancy in top ten health threats in 2019 [7].

The attitudes and beliefs of the parents have a crucial role in affecting the timing, amount, or the absence of vaccination in their offspring [8, 9]. Vaccine safety, side effects, and the propagation of false information via social media and personal relationships can affect vaccine hesitancy and refusal [10, 11]. On the other hand, trustworthy health care professionals and the presence of well-organized primary health care systems can help address and reduce vaccine hesitancy issues [9, 12].

The situation of Yemen is characterized by a long-standing conflict that, together with other factors, such as poverty and migration, leads to difficulties in maintaining a high level of coverage for routine childhood vaccination in the country [3, 13]. In addition to these structural determinants, parents' vaccine beliefs, vaccine knowledge, and attitudes determine vaccine refusal or hesitancy. Knowledge of vaccine refusal and hesitancy reasons in a local context is necessary in order to design targeted strategies that will increase vaccine coverage and prevent child deaths due to avoidable diseases.

Consequently, this study sought to explore vaccine refusal and hesitancy beliefs and reasons among the parents of Sana'a city, Yemen, and investigate the correlations between parents' socio-demographic characteristics and vaccine hesitancy.

Methods

Study Design and Setting

A cross-sectional analytical study was carried out in Sana’a city, Yemen, between October 2021 and March 2022. Sana’a City is one of the most densely populated urban centres in Yemen, which has undergone significant conflict for many years. This study was carried out among the outpatients’ departments in four governmental hospitals, namely Al-Thawra Modern General Hospital, Al-Kuwait University Hospital, Republican Teaching Hospital Authority, and Al-Sabeen Hospital for Maternity and Childhood.

Study population and sampling

The study population comprised Yemeni parents 18 years and above attending the outpatient clinics during the data collection period. Eligible respondents were married parents having at least one child requiring routine vaccinations for children. The ineligible respondents for the study included those who

refused to participate in the study, critically ill parents, those with mental problems, and incapable to give their consent.

Sample size was determined using the standard statistical procedure considering the estimated population size of the target group in Sana'a city with 95% confidence interval and 5% margin of error. The minimum sample size required was 403 respondents; but, 467 parents were included to compensate for the probability of no response. Convenience sampling technique was employed because of logistical issues related to hospital settings.

Data Collection Instrument

Data were gathered using a structured and pretested questionnaire through personal interviews. The questionnaire was adapted from previously published vaccine hesitancy instruments, particularly the WHO SAGE Vaccine Hesitancy framework and related published studies, and was modified to fit the Yemeni context [8, 15, 26, 27].

A panel of public health experts reviewed the adapted questionnaire to assess its relevance, clarity, and cultural appropriateness. Based on their recommendations, minor modifications were made before implementation. The questionnaire consisted of four sections: demographic characteristics of respondents, general information about childhood vaccination, parental beliefs and vaccine hesitancy, and factors associated with vaccine refusal. The questionnaire was translated into Arabic and pilot-tested among 39 parents who were excluded from the final analysis. The internal consistency of the instrument was assessed using Cronbach's alpha, which yielded a coefficient of 0.70.

Data analysis

Data were coded, keyed in, and analyzed using the Statistical Package for Social Sciences (SPSS) version .23. Descriptive statistics were applied to present the sociodemographic data, immunization data, parents' perceptions, hesitancy, and reasons for refusal. Inferential statistics were performed to establish a correlation between parents' features and vaccine hesitancy, where the criterion for significance was $p < 0.05$.

Ethical considerations

Ethical clearance was acquired from the Faculty of Medicine and Health Sciences and administrative authorities of the selected hospitals. Informed oral consent was obtained from each participant before collecting the data.

Result

(Table 1) A total of 467 parents took part in the study. The socio-demographic data of the participants are shown in Table 1. The predominant age group of participants was 19–35 years (61.5%), and 58.7% of participants were males. The vast majority of the respondents were married (95.1%) and lived in the urban areas (68.5%). With respect to their educational level, a quarter of the respondents were those who were university graduates (24.8%), while 17.8% were illiterate, and 28.7% had only basic education.

Data on childhood immunization among the respondents are summarized in Table 2. Almost all parents (98.7%) had knowledge on routine childhood vaccination. Eighty-four percent (84.2%) of parents claimed that their children received at least one vaccine dose. Completing the schedule of vaccines was achieved by 71.9% of parents, while 12.2% had completed partially, and 15.8% said that their children had never taken any vaccines.

Adverse events after immunization have been recorded in Table 3. Among the vaccinated subjects, 30.6% of the parents experienced at least one form of adverse effect after immunization, and 53.5% had no adverse effect. (Table 4)The most frequently mentioned adverse events include high fever (32.8%) and continuous crying (29.5%). In descending order, other common adverse events include diarrhea (17.7%) and rash (9.5%). Other forms of adverse events less mentioned are convulsion (6.2%) and paralysis (4.3%).

Belief of the respondents about immunizations and vaccine hesitancy are displayed in (Table 5) The majority of the parents strongly agreed that vaccinations can keep the children healthy by protecting them against dangerous illnesses (mean = 4.12, SD = 1.11). Furthermore, the participants felt that vaccination was very significant to the wellbeing of their children (mean = 4.30, SD = 1.05). They strongly disagree with the idea that vaccinations result in long-lasting health effects (mean = 2.16, SD = 1.25). The data on sources of information and reasons for refusal are presented in Table 6. The majority of the respondents obtained information regarding immunization from health care providers (80.7%). Information about concerns about adverse reactions was given by 49.3%, and 58.5% had negative information regarding vaccination. Problems of access have been identified: distance to vaccination services (18.6%) and time/limitation issues (15.6%).

(Table 7) Parents whose children refused to get vaccinated mentioned reasons such as doubt regarding vaccine safety (33.7%), distance to vaccination services (21.0%), and illness of the child at the time of vaccination (20.2%). Side effects were mentioned by 18.5%, and family situations by 6.6% of respondents.

Associations with vaccine hesitancy (Table 8) shows the associations between some of the selected demographic variables and vaccine hesitancy. Hesitance to receive vaccines was more pronounced among parents who had attained lower educational levels. Significantly more hesitant parents were those having attained only primary education or less than those with secondary or tertiary education ($p = 0.018$). Also, vaccine hesitancy was significantly more pronounced among parents who resided in rural areas as compared to urban parents ($p = 0.004$). Significant associations were found between monthly income and vaccine hesitancy. Hesitant parents had a lower monthly income of less than 30,000 Yemeni

Rials compared with parents having greater incomes (p = 0.009). Parents who had received any kind of negative information on vaccines were more hesitant to receive vaccines (p < 0.001). Moreover, vaccine hesitancy was significantly associated with trust in health workers. Parents with distrust toward health workers were significantly hesitant than parents who had trust in them as sources of vaccination-related information (p = 0.002). No significant associations were found between vaccine hesitancy and parents' age category (p = 0.214) or sex (p = 0.872).

Table 1
socio-demographic characteristics of participants (n = 467)

Variable	N	%
Age (years)		
• 19–35	287	61.5
• 36–50	156	33.4
• ≥ 50	24	5.1
Sex		
• Male	274	58.7
• Female	193	41.3
Marital status		
• Married	444	95.1
• Divorced	8	1.7
• Widowed	15	3.2
Education level		
• Illiterate	83	17.8
• Primary	134	28.7
• Secondary	107	22.9
• Diploma	27	5.8
• Bachelor	116	24.8
Residence		
• Urban	320	68.5
• Rural	147	31.5

Table 2
Childhood vaccination status among participants (n = 467)

Variable	n	%
Heard about vaccination		
• Yes	461	98.7
• No	6	1.3
Children vaccinated		
• Yes	393	84.2
• No	74	15.8
Vaccination completion		
• Complete	336	71.9
• Partial	57	12.2
• Not vaccinated	74	15.8

Table 3
Reported adverse events following immunization (n = 467)

Variable	n	%
Any side effects		
• Yes	143	30.6
• No	250	53.5
• Not vaccinated	74	15.8

Table 4
Type of reported side effects (n = 305)

Side effect	N	%
• High fever	100	32.8
• Persistent crying	90	29.5
• Diarrhea	54	17.7
• Rash	29	9.5
• Convulsions	19	6.2
• Paralysis	13	4.3

Table 5
Parental beliefs and vaccine hesitancy (Likert scale, n = 467)

Statement	Mean	SD	Interpretation
• Vaccines protect children from serious diseases	4.12	1.11	Agree
• Hesitation to vaccinate children	2.60	1.43	Disagree
• Vaccines may cause short-term fever	4.12	1.03	Agree
• Vaccines cause permanent health problems	2.16	1.25	Disagree
• Vaccination-preventable diseases are serious	3.85	1.18	Agree
• Importance of vaccination for child health	4.30	1.05	Strongly agree
• Following healthcare recommendations	4.07	1.11	Agree
Overall belief score	**3.67**	**0.50**	**Positive**

Table 6
Refusal factors and information sources (n = 467)

Variable	Category	n	%
• Information from health workers	Yes	377	80.7
• Concern about adverse effects	Yes	230	49.3
• Distance as barrier	Yes	87	18.6
• Time/waiting as barrier	Yes	73	15.6
• Received negative information	Yes	273	58.5

Table 7
Main reasons for vaccine refusal (n = 243)

Reason	N	%
Doubt about vaccine safety	82	33.7
Distance to clinic	51	21.0
Child illness	49	20.2
Side effects	45	18.5
Family circumstances	16	6.6

Table 8
Factors associated with vaccine hesitancy among parents (n = 467)

Variable	Hesitant n (%)	Not hesitant n (%)	p-value
Age group (years)			
• 19–35	92 (32.1)	195 (67.9)	0.214
• ≥ 36	57 (31.3)	123 (68.7)	
Sex			
• Male	88 (32.1)	186 (67.9)	0.872
• Female	61 (31.6)	132 (68.4)	
Education level			
• Primary or less	87 (38.4)	139 (61.6)	**0.018**
• Secondary or higher	62 (26.2)	179 (73.8)	
Residence			
• Rural	59 (40.1)	88 (59.9)	**0.004**
• Urban	90 (28.1)	230 (71.9)	
Monthly income			
• < 30,000 YR	59 (41.5)	83 (58.5)	**0.009**
• ≥ 30,000 YR	90 (27.7)	235 (72.3)	
Received negative information			
• Yes	103 (37.7)	170 (62.3)	**< 0.001**
• No	46 (23.7)	148 (76.3)	
Trust in health workers			
• Yes	102 (27.1)	275 (72.9)	**0.002**
• No	47 (52.2)	43 (47.8)	
*Chi -square test			

Discussion

Key insights about the parent's beliefs and vaccine hesitancy and refusal predictors for routine childhood vaccinations were derived from this study in Sana'a city, Yemen. While routine childhood vaccination is known to be very effective as a public health measure, the study revealed that vaccine hesitancy is still very common, accounting for nearly one-third of the parents, despite the fairly high vaccination rate. This

finding is consistent with the increasing body of evidence worldwide showing that vaccination rate does not guarantee vaccination acceptance.

Vaccine hesitancy and issues with vaccine safety

Issues with vaccine safety proved to be one of the key determinants of vaccine hesitancy in the current research. As stated in the report published by WHO and SAGE working group, confidence in vaccine safety, effectiveness, and healthcare system were the crucial factors in vaccine hesitancy [6, 15]. The same patterns of correlation between confidence and vaccine safety were revealed in various low- and middle-income countries, as parent's fear of adverse effects and their concerns with the safety of vaccines resulted in delays or refusal to vaccinate [8, 16].

As reported in this study, many parents observed side effects after immunization procedures, namely fever and excessive crying of their children. Even though side effects associated with vaccines are quite common and do not require special treatment, lack of information on how parents should deal with them could cause additional concerns and strengthen negative beliefs about vaccine safety [14, 17].

Misinformation and negative information exposure role

The association between exposure to negative information and vaccine hesitancy has been found in this paper. More than half of the respondents admitted the presence of misinformation, mainly through social media, families and communities. As shown by research from BMJ Global Health and others, misinformation is a key component in enhancing vaccine refusal in the modern world [11, 19].

In conflict settings like Yemen, where there is less availability to accurate health information and low institutional trust, rumors and misinformation can easily propagate [3, 20]. It is therefore evident the necessity of adopting more communication strategies that will address misinformation explicitly.

Sociodemographic factors associated with vaccine hesitancy

Lower education level was significantly associated with higher rates of vaccine hesitancy. Such findings have been widely reported before, as health literacy and critical thinking about health information play an important role in this issue [8, 21]. Hence, individuals from disadvantaged families are more prone to misinformation and less inclined to interact with health-related professionals.

Living in a rural area was found to be another factor that contributed to higher vaccine hesitancy rates. Residents of rural areas are known to face various challenges, including insufficient access to vaccination services, a shortage of skilled health workers and greater reliance on community stories [16, 22]. Analogous results have been observed in other low-resource countries [23].

Being from a family with lower economic status also significantly increased the odds of vaccine hesitancy. Even though vaccination is free for all children in Yemen, some indirect expenses, such as transport costs and income losses, might act as barriers [17, 24]. Therefore, economic disadvantage can be a contributing factor to vaccine hesitancy by virtue of its effect on accessibility issues.

Trust in health care providers

Fortunately, the findings of the current study indicate that health care providers have been recognized as the main source of information regarding vaccines among the respondents involved. Trust towards medical professionals is believed to be among the best indicators of vaccine acceptance [9, 12]. Empathy-based communication by medical professionals could play a significant role in combating any misinformation about vaccines and addressing the concerns of parents [18, 25].

Implications for public health

The conclusions drawn from this research suggest that there is a requirement for vaccination programmes that take into account the structural and cognitive factors inhibiting immunization. Vaccination education programmes that educate people about the safety of vaccines, possible adverse reactions, and the advantages of full immunization are crucial. The priority should be rural areas and mothers who lack educational and economic resources. Improving the ability to communicate among health care professionals should be viewed as an important intervention for vaccine hesitancy and immunization coverage [6, 11].

Limitations

The present study is characterized by various limitations. The cross-sectional nature of the research limits the ability to make causal inferences; besides, the use of a convenience sample in this study might have affected its generalizability. Self-reporting of vaccination status and the presence of side effects are vulnerable to biases related to recall bias. Furthermore, the lack of multivariate regression in the analysis process prevents adjusting for other variables that may influence the results [20, 22].

Conclusions

Although routine childhood vaccination coverage in Sana'a City was relatively high, vaccine hesitancy remains an important public health concern among a proportion of parents. Concern about vaccine safety, misinformation, low education level, rural residence, and low income were significant factors associated with hesitancy. Trust in healthcare providers played an important role in improving vaccine acceptance. Strengthening health education, addressing misinformation, and improving communication between healthcare workers and parents are essential to enhance childhood immunization uptake in Yemen.

Declarations

Ethics approval and consent to participate: The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine and Health sciences, Sana'a University, Yemen (Approval No: 26/13-6). Informed oral consent was obtained from all participants prior to data collection.

Consent for publication: Not applicable

Competing interests: The authors declare that they have no competing interests as defined by BMC, or other interests that might be perceived to influence the results and/or discussion reported in this paper.

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Authors' contributions:

F.M (First author) conceived and designed the study, collected data, and drafted the main manuscript text. N.A. supervised the research process, performed statistical analysis, provided critical guidance, and contributed to manuscript revision. G.I. was responsible for data entry. A.F; and A.H. participated in data collection. All authors reviewed and approved the final manuscript.

Authors Information

Fawz Mohammed Abol Gaith[1]

Associate Professor of Community Health Nursing, Nursing Division Faculty of Medicine and Health science Sana'a University, Sana'a City, Yemen

Email: Fawzmmab@gmail.com

Nabil Ahmed Ahmed Al-Rabeei[2]
Professor of Public Health and Dietetics
Department of Community Health Nursing, Nursing Division Faculty of Medicine and Health science Sana'a University, Sana'a City, Yemen

Email: nabilalrabeei@hotmail.com

Ghaida'a Ibrahim Ahmed Hafedh[3] **(*Corresponding Author*)**
Lecturer of Public Health and Clinical Nutrition
Department of Community Health and Nutrition, Faculty of Medicine and Health Sciences, Al-Razi

University, Sana’a City, Yemen
Email: ghaidaibrahim1997@gmail.com

Aisha Faisal Ahmed Al-Wadhaf[4]
Lecturer of Public Health
Department of Community Health and Nutrition, Faculty of Medicine and Health Sciences, Al-Razi University, Sana’a City, Yemen
Email: aishaalwadhaf@gmail.com

Ahmed Hamood Al-Shahethi

Assistant professor of Public Health

Department of Community Health Nursing, Nursing Division Faculty of Medicine and Health science Sana'a University, Sana’a City, Yemen
Email: alshahethi71@yahoo.com

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