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Original Article

Determining the Predictors of Vaccine Hesitancy: A Nation-Wide Study Using WHO SAGE WG Developed Vaccine Hesitancy Questionnaire

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ABSTRACT

Background: Vaccine hesitancy refers to the reluctance or outright refusal to be immunized despite vaccine availability. It spans from full acceptance to complete rejection of all vaccines, with most hesitancy instances lying in between. Factors influencing vaccine hesitancy encompass confidence (trust in vaccines, delivery systems and providers), convenience (accessibility of immunization services), complacency (perceived lack of necessity or value for vaccines), skepticism (influenced by knowledge and information) and psychological elements like conspiratorial thinking. This comprehension is crucial for effectively addressing vaccine hesitancy. The study aimed to determine predictors linked to vaccine hesitancy within the studied population. **Materials and Methods:** Employing a cross-sectional survey design, the investigator acquired foundational knowledge through various courses on vaccine safety, biology, hesitancy and anti-vaccination beliefs. Participants, consenting adults from Mysore city visiting JSS Hospital for any reason, underwent purposeful sampling based on specific eligibility criteria. **Results:** The study included a diverse group, with the female population comprising 59.87%. Demographics, such as age and socio-economic status, were also examined. Statistical analysis utilized SPSS software and data presentation involved mean, standard deviation, percentages and visual representations. The study identified a vaccine hesitancy prevalence of 23.12%, with males and the age group of 40-49 years showing higher likelihoods of hesitancy. **Conclusion:** By scrutinizing a subgroup, researchers gleaned insights into factors fueling hesitancy, paving the way for targeted interventions and strategies to foster vaccine acceptance and uptake.

Keywords: Vaccine hesitancy, Vaccine refusal, Intervention, Vaccine confidence, WHO SAGE WG.

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INTRODUCTION

Edward Jenner coined the term "Variolae vaccinae," meaning cowpox, to describe the disease. This term eventually led to the creation of the word "vaccine."[1] Vaccination is acknowledged by the World Health Organization as one of the most successful economical strategies for enhancing overall health outcomes.[2] Globally, approximately 68% of advancements in human health are attributed to technical improvements, including vaccines, micronutrient fortification and deworming medications.[3] India has a rich history of vaccine research and production, closely linked with global developments. In the late 19th century, while Western nations established vaccine research institutions, British rulers set up around 15 vaccine institutes in India, starting in the 1890s. Notably, in 1897, Haffkine created the first-ever plague vaccine at Mumbai's Plague Laboratory, which later became the Haffkine Institute.[4] Vaccine acceptance is complex and varies by context, location and specific vaccines. Understanding these factors is crucial for developing targeted strategies to improve acceptance rates, combat vaccine hesitancy and protect public health. Vaccine hesitancy refers to the reluctance or unwillingness to be immunized despite vaccine availability. It ranges from complete acceptance to outright rejection of all vaccines, with most hesitant individuals falling in between. Factors influencing vaccine hesitancy includes: Confidence: Trust in the vaccine, delivery system and provider; Convenience: Access to immunization services; Complacency: Perceived lack of need or value for vaccines; Skepticism: Influenced by knowledge and information; and psychological factors: Such as conspiratorial

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thinking. Understanding these factors is essential for effectively addressing vaccine hesitancy.[5] The purpose of this investigation was to determine the predictors associated with vaccine hesitancy within the population under investigation.

MATERIALS AND METHODS

Study design and Procedure

A cross-sectional survey design was used in this investigation. To lay a solid foundation for the study, the investigator completed courses in vaccine safety basics from the World Health Organization, International Vaccine Institute and from the Indian Academy of Pediatrics (IAP). Approval was granted by the Institutional Ethical Committee of JSS Hospital, located on MG Road in Mysore, India, during the meeting on October 14, 2020 (Approval number: JSSMC/IEC/141020/43NCT/2020-21).

Study population

The inclusion category target population comprised adults residing in Mysore city who visited JSS Hospital, Mysore, for any reason. Purposeful sampling was employed based on specific eligibility criteria using the formula $n=[(z\alpha)^2\times p\times q]/d^2$,[6] where z represents the standardized normal deviate (1.96 for 0.05), *p* denotes the prevalence of interest, q is 1-*p* and d indicates the expected clinical variation (5%). Participants were approached during their hospital visits and those who met the eligibility criteria were enrolled immediately after being informed about the research institution and study objectives. Those who were not willing to participate were excluded from study. A consent form, adhering to Indian Council of Medical Research guidelines and available in both English and Kannada, outlined participant expectations. Participation was voluntary and participants were given a questionnaire designed to uncover factors and associations related to vaccine hesitancy, which took approximately 10-12 min to complete.

Study tool and assessment of questionnaire

Participants were asked to provide basic demographic information and complete a survey questions created by the SAGE Working Group of the WHO (2015),[7] which included the Potential Vaccine Hesitancy Survey Questions: Version 1.0. To better understand the study population's responses, the researcher categorized participants into positive and negative response groups. "Positive responses" indicated support for vaccines and immunizations, while "negative responses" reflected opposition or skepticism. Positive reactions included categories such as "supporter/accepting," "strong supporter," and "supporter." Negative reactions encompassed "refuser/hesitant" and "strong refuser/antivaccinationist." In the analysis tables, participants with positive answers were labeled as "Accepter," and those with negative responses were termed "Hesitant." Vaccine hesitancy was assessed based on participants' answers to specific questions, such as hesitating or refusing vaccinations for their children.

Data collection method and Data analysis

Information was gathered using a questionnaire developed by the WHO SAGE Working Group over the period from October 2020 to November 2023. The questionnaire was available in English and was translated and back-translated into Kannada, considering the investigation was carried out in a Kannada-speaking community.

Statistical analysis

JSS University-licensed SPSS software version 22 was used for statistical analysis. The mean, standard deviation and percentages were used to display the quantitative data.

RESULTS

Characteristics of the participants

During the research period, 800 eligible subjects were enrolled (40.75% (*n*=326) were current parents, while 59.25% (*n*=474) were future parents. The participants hailed from 23 states and 2 union territories, representing a diverse sample. The study revealed a vaccine hesitancy prevalence of 23.12% (*n*=185), with 21.87% (*n*=175) admitting to refusing specific vaccines.

Demographic characteristics of the study participants

During the study, female population made up 59.87% (*n*=479) of the overall participants. The mean age of the study population was 29.67±10 years. The younger age group of 18 ≤ 29 were 66% (*n*=528) and 72.95% (*n*=583) were belongs to nuclear family. The study revealed that 48.05% (*n*=388) of the participants fell into the Upper Lower socio-economic status category (Table 1).

Table 1: Demographic characteristics of the study participants.

Parameters		Total (N=800), %
Gender	Male	321 (40.1)
	Female	479 (59.9)
Age group (In years)	18≤29	528 (66)
	≥30≤39	150 (18.8)
	≥40≤49	67 (8.4)
	≥50≤59	41 (5.1)
	≥60	14 (1.8)
Type of family	Nuclear	583 (72.9)
	Joint Family	166 (20.8)
	3 Generation Family	51 (6.4)
Marital status	Unmarried	417 (52.1)
	Married	377 (47.1)
	Divorced	(0.8)

Predictors of vaccine hesitancy

After conducting bi-variate analysis, several predictor variables for vaccine hesitancy were identified. Male gender (OR: 1.785, CI LL: 1.294, CI UL: 2.463): Male participants were 1.785 times more likely to exhibit vaccine hesitancy compared to female participants. A detailed explanation of these findings can be found in Table 2.

DISCUSSION

This study is a notable achievement as it's the first nationwide research in India, to address vaccine hesitancy comprehensively. Data from 800 participants revealed a vaccine hesitancy rate of 23.12%, with 21.87% being vaccine refusers. A parallel study in Saudi Arabia showed a 20% hesitancy rate.[8] The study also noted that men largely influence vaccination decisions in Indian families, influenced by trust in health policies and providers, financial constraints and work schedules.[9] Our study showed higher hesitancy among men, aligning with previous research.[10] Older age groups were more accepting of vaccines, while unmarried individuals showed higher hesitancy rates, possibly due to social media influence and lack of experience with disease severity.[11] The study found that 73.92% of nuclear families showed vaccine hesitancy, followed by three-generation families at 66.66%. Grandparents' influence on vaccination decisions hasn't been widely studied. Nuclear family hesitancy often stems from concerns about side effects and time constraints, aligning with other research.[12-14] Single-parent households, especially single mothers, face challenges due to time constraints and concerns about vaccine necessity, as highlighted by similar studies.[15] There's a need to further understand single fathers' perspectives on vaccination. Factors like insufficient information and unequal decision-making within households contribute to vaccine hesitancy, emphasizing the importance of comprehensive strategies to address this issue.[16] In our study, urban areas showed a high vaccine hesitancy rate of 70.32%, aligning with similar study findings linking urban hesitancy to younger age, frequent information searches and distrust in vaccination plans.[17] Non-healthcare professionals in our study exhibited an 80.13% hesitancy rate, possibly due to limited awareness about vaccination benefits. Education level showed mixed results on hesitancy, contrary to another research findings,[11] indicating a need for

Table 2: Predictors of vaccine hesitancy.

Variables		OR*	CI# lower limit	CI# upper limit
Gender	Female			
	Male	1.785	1.294	2.463
Age Group	18 ≤ 29 years	3.660	1.248	10.732
	≥30 ≤ 39 years	2.513	0.828	7.630
	≥40 ≤ 49 years	3.922	1.189	12.929
	≥50 ≤ 59 years	1.400	0.412	4.756
	≥ 60 years			
Type of Family	3 Generation Family			
	Nuclear	1.418	0.770	2.612
	Joint Family	1.279	0.847	1.929
Marital Status	Divorced			
	Unmarried	5.128	0.927	28.375
	Married	4.444	0.803	24.606
Place of origin	Rural			
	Urban	1.007	0.744	1.364
Profession	Health care professional			
	Non-health care professional	2.977	2.173	4.077
No. of children under care	≥ 3 children			
	1 child	5.351	0.471	60.784
	2 children	4.980	0.441	56.181
	3 children	1.200	0.089	16.239
Immunization history	Fully immunized			
	Partially immunized	1.185	0.810	1.734
	Not immunized	0.872	0.414	1.837

Variables		OR*	CI# lower limit	CI# upper limit
Education Level	Profession Or Honor			
	Graduate	1.324	0.739	2.372
	Intermediate Or Diploma	2.733	1.375	5.433
	High School Certificate	4.645	1.766	12.221
	Middle School Certificate	2.710	0.523	14.046
	Primary School Certificate	3.161	0.808	12.373
	Illiterate	-	-	-
Occupational status	Legislators, Senior Officials			
	Professional	0.767	0.138	4.264
	Technicians And Associate	0.405	0.066	2.483
	Clerks	1.700	0.271	10.683
	Skilled Workers/Shop Owners	2.100	0.297	14.873
	Skilled Agricultural and Fishery	0.125	0.008	1.998
	Craft And Related Trade	1.750	0.173	17.686
	Plants and Machine Operators	5.000	0.348	71.900
	Elementary Occupation	7.000	0.890	55.048
	Unemployed	1.540	0.277	8.554
Total Family Monthly Income	≥ 199,862			
	99,931-199,861	0.570	0.171	1.524
	74,755 -99,930	0.508	0.156	1.648
	49,962-74,755	0.281	0.088	0.899
	29,973- 49,961	1.286	0.429	3.856
	10,002-29,972	1.187	0.401	3.514
	≤ 10,001	0.965	0.336	2.768

targeted education efforts.[18] Lower-income families displayed significant vaccine hesitancy (72.98% to 78.26%), underscoring the impact of financial constraints on vaccination decisions. Addressing knowledge gaps, building trust and improving affordability are crucial for promoting vaccine acceptance across diverse populations.

CONCLUSION

Vaccine hesitancy poses a significant challenge to the healthcare system, with no universally effective methods to address the diverse concerns of hesitant individuals. The concerns of vaccine-hesitant individuals are varied and require localized communication analyses of knowledge, attitudes and practices. These should be combined with a thorough understanding of social norms, cultural beliefs and traditions among key stakeholders, such as parents, future parents, caregivers and healthcare providers. The study found a vaccine hesitancy prevalence of 23.12%. To better understand decision-making and influences on vaccination behavior, it is crucial to balance quantitative data with qualitative studies across different regions.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

IAP: Indian Academy of Pediatrics; **SPSS:** Statistical Package for Social Science; **SAGE:** Strategic Advisory Group of Experts; **WHO:** World Health Organization; **#CI LL:** Confidence interval lower limit; **#CI UL:** Confidence interval upper limit; **OR*:** Odd Ratio.

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