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Investigating Public Concerns, Awareness, and Attitudes Toward Vaccination Through Qualitative Interpretation and Descriptive Biostatistical Evaluation: A Community-Based Perspective

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ABSTRACT

Purpose: Biostatistics serves as an important foundation for vaccination acceptance by providing credible evidence on the effectiveness and safety of vaccines. Therefore, this study aimed to explore the role of Biostatistical Evidence-Based Health Care Awareness, communication and management of healthcare, Social Media Influence, Healthcare Institutional Trust, and Vaccination Safety Anxiety and Fear on attitudes toward vaccination in urban and semi-urban communities. Design/ method/ approach: The present study used a descriptive cross-sectional research design integrating quantitative descriptive analysis and qualitative interpretive inquiry. Data were gathered from residents of urban and semi-urban communities using judgemental sampling. A descriptive biostatistical technique was used for the analysis of quantitative data, and themes were developed for the analysis of qualitative data. Findings: The results revealed that vaccination perceptions of individuals were shaped by factors such as biostatistical evidence-based healthcare awareness, healthcare management and communication, social media influence, trust in healthcare institutions, and fear and anxiety regarding vaccination safety. The results also reported that semi-urban communities showed greater concerns regarding vaccination safety and misinformation. Originality: This research provides a clear understanding of vaccination perception by integrating biostatistical, institutional, social, and psychological elements. The study also provides a comparative analysis of public attitudes, awareness, and concerns toward vaccination in semi-urban and urban communities.

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1. Introduction

Descriptive biostatistics is one of the essential methodological tools in modern healthcare research to examine public health issues and interpret public health-related data (Sakarna et al., 2025). Biostatistics is the application of different statistical methods in public health, medical, and biological sciences for collecting, organizing, analyzing, and interpreting data. The focus of descriptive biostatistics is on summarizing observed data into an understandable and meaningful form without making future predictions (Dong, 2023). Different statistical measures such as standard deviation, range, mode, median, mean, percentages, and frequencies are commonly used to describe the variability, distribution, and characteristics of collected data (Siregar, 2025). In the context of vaccination research, descriptive biostatistics helps researchers evaluate community attitudes, awareness levels, and concerns in a systematic way regarding healthcare systems and immunization practices (Patlolla et al., 2026).

Vaccination is considered an effective intervention in public health to prevent different infectious diseases, improve overall community health outcomes, and reduce mortality rates (Alanazi et al., 2024). Vaccination plays a key role in eliminating and controlling diseases such as COVID-19, influenza, measles, and polio. Despite these achievements of vaccination, public hesitancy, misconceptions, and concerns regarding vaccination continue to challenge healthcare systems globally (Brumbaugh et al., 2025). Fear about the safety of vaccination, exposure to misinformation through digital and social media, and declining levels of trust in healthcare institutions have significantly affected public attitudes and

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awareness regarding vaccination (Rodrigues et al., 2023). There is a need for qualitative interpretation of community perceptions in order to understand these concerns (Zaifuddin et al., 2024).

The importance of evidence-based healthcare research and statistical thinking has increased because of the increasing complexity of public health problems. Healthcare and medical professionals should understand the processes of interpretation, data analysis, and scientific investigation of findings to support informed healthcare decisions (AbdulRaheem, 2024). Biostatistics competencies allow healthcare practitioners and researchers to examine health behaviors, measures the effectiveness of healthcare interventions and evaluate public perceptions (Chaoubah, 2021). Studies related to descriptive statistics and vaccination help scholars identify the reasons for vaccine hesitancy. They also examine the effects of social media and misinformation on community attitudes (Orsini et al., 2022). By using different graphical presentations and summaries, descriptive biostatistics converts a large volume of data into understandable findings that can guide public health communication strategies and healthcare policy (Karunarathna et al., 2025).

Fear related to vaccine safety and anxiety are major concerns regarding vaccination. Individuals mostly show fear regarding short-term side effects such as allergic reactions, fatigue, pain, and fever, whereas others have shown concern regarding the long-term consequences of vaccination on health (Gauna et al., 2025). Vaccine hesitancy is further influenced by uncertainty about the development process of vaccines and distrust toward healthcare institutions and companies. Researchers can quantify these fears among the public and measure the number of individuals having concerns regarding vaccination within a population (Mehta et al., 2024). Different demographic differences can also be identified by statistical analysis in terms of vaccination attitudes, awareness, and fear.

Additionally, the rapid growth of social media and other digital communication platforms has significantly affected public attitudes and awareness toward vaccination. Different platforms such as WhatsApp, YouTube, Twitter, and Facebook are key sources of information. On the other hand, they are also sources of misleading narratives, conspiracy theories, and misinformation regarding vaccination (Leonforte et al., 2026). Information overload, peer influence, and community narratives mostly create uncertainty and confusion among individuals. By using different descriptive biostatistical methods, scholars can assess the frequency of exposure to misinformation, analyze the reliance of the public on different social media sources, and explore the relationship between vaccine hesitancy and online information (Gu et al., 2023). Studies provided evidence-based insight the way communication environments shape vaccination decisions and public health behaviors (Jumah et al., 2025).

Vaccine acceptance is also influenced by the factor of trust in public health leadership, doctors, and healthcare institutions (Cao et al., 2024). Public confidence in transparent leadership and healthcare systems is important for disease prevention efforts and successful vaccination campaigns. Individuals who perceive institutions as transparent and credible, and trust healthcare professionals, are likely to comply with medical recommendations and support vaccination programs (Mathur et al., 2026) Evaluation through descriptive statistics helps health scholars measure the level of trust in institutions, assess public confidence in healthcare leadership, and explore the relationship between vaccination attitudes and trust (Krastev et al., 2023). This statistical evidence provide support to the strengthening of public health policy making and development of effective strategies of effective healthcare communication.

Vaccination is one of the most vital interventions in public health; however, public attitudes, awareness, and concerns toward vaccination vary in semi-urban and urban areas. These differences are shaped by multiple factors, including the level of healthcare literacy, the effectiveness of healthcare communication, exposure to social media for information, trust in healthcare institutions, and perceptions of vaccination safety. Urban populations may have access to scientific information and healthcare services, whereas semi-urban populations mostly face difficulties in these aspects (Khan et al., 2025). Therefore, purpose of this study is to explore role of Biostatistical Evidence-Based Health Care Awareness, communication and management of healthcare, social media Influence, Healthcare Institutional Trust, and Vaccination safety anxiety and Fear impacting attitude of individuals towards vaccination in urban and semi-urban communities.

2. Literature Review

2.1 Descriptive Biostatistical Evaluation

Descriptive biostatistics is vital component pf public health research as it helps scholars to interpret, analyze, summarize, and organize data related to health in a meaningful and systematic way (Rossi, 2022). Different studies examining public concerns, attitudes, and vaccination awareness, descriptive statistical methods are used widely to understand perception and behavior within a community. The focus of descriptive statistics is on presenting data observed without making prediction and using different measures such as standard deviation, range, mode, median, mean, percentage, and frequencies (Daniel & Cross, 2018). Researchers are enables by these statistical techniques to transform large data into findings that reflects experiences and opinions of public regarding vaccination. Studies revealed that biostatistical evaluation is vital to examine concerns of community related to safety of vaccination and trust in institutions

of healthcare. studies also assess to explore the effect of misinformation in attitude of public towards vaccination (Kahlenberg et al., 2023).

Scholars mentioned that vaccination programs are most effective public health interventions to improve public health outcomes and prevent infectious diseases. Whereas, despite the availability of vaccine, and scientific advancements, vaccine resistance and hesitancy are significant challenges in most of societies (Brumbaugh et al., 2025). Studies discussed that scholars have used descriptive statistics for the evaluation of different factors impacting attitude of public towards vaccination, including distrust in healthcare systems, misinformation, lack of awareness, and fear of side effects (Pagano et al., 2022). By using descriptive statistical analysis, scholars are able to assess the percentage of individuals who are willing to receive vaccine, examine difference in attitude across different groups of demographics such as socioeconomic status, education, gender, and age, and identify common concerns regarding safety of vaccine. As a result of this approach, researchers get a clearer understanding of the way vaccine is perceived by different communities and enable scholars to find out patterns that are associated with refusal and acceptance of vaccine (AlShurman et al., 2021).

Different studies that are linked with community-based vaccine, evaluation through descriptive statistics plays vital role to assess the impact of community narratives, peer influence, and social media on public health behavior. A number of individuals obtain information related to vaccine from social networks and online platforms, where conspiracy theories and misinformation are circulated frequently. By using different tools of descriptive statistics, researchers are able to measure the number of participants who are exposed to misinformation, analyze the association between vaccine attitude and information exposure, and evaluate trust level of public in different online sources (Lee et al., 2022). Statistical tools such as frequency distributions, charts and percentage also help the scholars to present their findings in an understandable and simple format, allowing healthcare professionals and policymakers to look for areas where educational intervention and awareness campaigns are needed. Thus, descriptive biostatistics has significant role to play in developing perceptions and creating awareness among public regarding vaccination (de Koning et al., 2024).

Moreover, descriptive biostatistics evaluation provide support to the qualitative interpretations of public attitudes and concerns towards vaccination by providing evidence-based insights into healthcare behaviors and community experiences. Different studies focusing on hesitancy of vaccine, scholars mostly gather information regarding fear of long-term and short term side effects, confidence in government vaccine policies and leadership, and trust in healthcare institutions and doctors (Troiano & Nardi, 2021). By using descriptive statistics, researchers are enabled to quantify these public concerns and present then in visual presentations and statistical summaries. As a result of this approach, interpretations of qualitative findings is improved. Also, this approach strengthens the validity and reliability of community-based research. In other words, descriptive biostatistics provides foundation for understanding concerns related to vaccination, attitudes, and awareness, and assists authorities of public health to develop effective strategies of communication with aim to improve community health outcomes and vaccine confidence (Paul et al., 2021).

2.2 Anxiety and Fear About Vaccination Safety

Past studies have explored that fear and anxiety regarding safety of vaccine is one of major factor effecting vaccine resistance and hesitancy. Most of studies conducted recently demonstrated that most of the individuals were concerned regarding long-term and short term side effects of vaccines during Covid-19 Pandemic (Sarnaik et al., 2026). Common gears mentioned by individuals included unknown future health complications, chronic diseases, infertility, allergic reactions, fatigue, and fever. Scholars reported that uncertainty regarding development of vaccine, and distrust towards healthcare institutions and pharmaceutical companies enhances hesitation and fear (Arefin et al., 2021). Likewise, studies also reported that lack of communication regarding safety of vaccine also contributed to psychological scepticism and anxiety among public (Larson et al., 2022).

Several qualitative studies also mentioned that fear among individuals was intensified when they perceive that medical institutions lack accountability and transparency. These concerns are common in most of individuals with limited previous negative experiences of healthcare and limited health literacy. For the same reason, past studies mentioned that uncertainty regarding credibility of institutions preparing vaccine and perception of vaccine risk shape attitude of public towards vaccination. Study by Erchick et al.(Erchick et al., 2022) examined the perception regarding vaccination by using descriptive statistical analysis and qualitative interpretation. Karafillakis and Larson (Karafillakis & Larson, 2017) mentioned that anxiety and fear among public regarding safety of vaccination impacts their trust level that later have negative effect on the vaccine usage.

2.3 Community Narratives, Social Media and Online Misinformation

Several studies mentioned that social media and community narratives influence public attitude towards vaccination and awareness significantly. Scholars have observed that different online platforms such as WhatsApp, YouTube, and

Facebook are major sources of vaccination related information (Cinelli et al., 2020). Some scholars also mentioned that social media platforms are also the major source of conspiracy theories and misinformation. Study by Rathje et al.(Rathje et al., 2022) mentioned that repeated exposure regarding anti-vaccine narratives through echo chambers reduced trust in scientific information and reduced trust of public towards vaccination. Likewise, research by Loomba et al.(Loomba et al., 2021) also revealed that misinformation about effectiveness and safety of vaccine affected intentions of vaccination among public.

Scholars also mentioned that social networks and peer influence play a key role in shaping public behavior related to health. Community members rely mostly on online influencers, relatives, and friends, especially during periods of uncertainty. Moreover, information overload from different sources also creates difficulty, stress, and confusion to distinguish false claims from accurate information (Islam et al., 2020). Past studies also emphasized that communication interactions and digital communication environments have substantial effect on public health behaviors and vaccine perception (Puri et al., 2020).

2.4 Trust in Healthcare Institutions and Leadership Transparency

Trust in public health leadership and healthcare institutions are identified by a number of studies as important determinants to accept vaccine (Sapienza & Falcone, 2022). Past studies suggested that individuals having trust on government healthcare agencies, healthcare professionals, and doctors are likely to perceive vaccination as necessary, effective, and safe. Scholars also demonstrated that higher level of trust in healthcare professionals increase willingness of receive vaccination significantly (Freeman et al., 2022). Similarly, scholars mentioned that inconsistent messaging related to public health and lack of transparency in communication of government contributed to vaccine hesitancy and distrust. Studies also emphasized the importance of ethical leadership and institutional credibility to maintain confidence of public during situation of health crises. Transparent communication about vaccine benefits, risks, approval processes, and development can improve understanding of public and minimizes misinformation linked anxiety (Jennings et al., 2021).

Moreover, scholars demonstrated that communities that respond positively when healthcare workers actively engage with public concern, provide evidence based, and clear guidance (Wilson & Wiysonge, 2020). Thus, the literature indicates that transparency, credibility, and trust are important elements to improve public participation and vaccine confidence in immunization program. Literature also indicates that a number of healthcare and medical students face difficulties to understand concepts of statistics and interpret findings of research (Sutrisno et al., 2025). Likewise, healthcare professionals face challenges in interpreting sophisticated methods of statistics being used in medical studies. Thus, integrating biostatistical evaluation with community based vaccination research is vital to improve evidence based healthcare understand and produce scientifically reliable findings (Prihanti, 2017).

3. Methodology

3.1 Research Design

Descriptive mixed Bio-statistical design of research used in this study for the exploration of community's perception about usage of vaccination. Furthermore, qualitative and quantitatively interpret public beliefs, attitudes and behavioral intentions towards practices of immunization. qualitative interpretive inquiry integrated with descriptive techniques of biostatistics get a multidimensional awareness about vaccination perceptions within multiple groups of community. Quantitative analysis focused to measure risk perception, awareness, trust, attitudes, and vaccination behaviors with the help of descriptive statistics, on the other hand the qualitative analysis examined the contextual social influences, emotions, meanings, and managerial implications linked with hesitation and acceptance of vaccine.

Current study was based upon standards of managing public health and The Biostatistics, emphasizing the statistical reasoning application to behavioral analysis and decision-making of healthcare at community-level. Moreover, selected concepts from theory of community engagement and management of health behavior were combined for examining how institutional trust, healthcare governance, leadership communication, and public administration influence acceptance of vaccination.

This descriptive and cross-sectional framework was used due to the objective of study for the assessment of community perception at specified time without manipulation of variables.

Current research design was used to attain broader response of community allowing the combination of frequency based quantitative measurements and qualitative thematic analysis.

3.2 Philosophical Underpinning

Pragmatic research paradigm was used in this study which propagates the integration of both social interpretation and numerical evidence. This approach was selected because perception about vaccination is not purely social or statistical

phenomena, rather, a complex one which is influenced by cultural beliefs, communication systems of healthcare, epidemiological realities, emotional responses, and practices of institutional management.

positivist orientation lead by the quantitative analysis emphasizing public perceptions' numerical description and measurements of objectives. interpretive orientation was opted in the qualitative component for the recognition of vaccination perceptions of individuals with the help of narratives, experiences, media exposure and religious influences.

3.3 Area and Study Setting

Current study was conducted in the semi urban and the urban communities. Objective of Including semi urban and urban communities was to enable the comparison of perceptions about vaccination across varying socio-economic, educational and accessibility of healthcare context.

This study's setting includes units of public vaccination, centre of public health, residents of local community, gathering areas of community, and clinics of family health

Purpose of selecting these setting was that the public awareness session about vaccination often take place there and the representation of public interaction places.

3.4 Target Population

Target population was the residents of community aged eighteen years and above, eligible to take and receive decision about vaccination.

Study's populations included parents, guardians, elderly individuals, young adults, workers of healthcare, leaders of community, students, and teachers.

Heterogeneous group of participants was included to enhance the community perspectives representativeness and among different demographic groups enabled descriptive comparative analysis.

3.5 Criteria of Inclusion

Participants included based on their age 18 years and above, at least one-year residents of community, having understood about vaccination, voluntarily participated, and having good communication style.

3.6 Criteria of Exclusion

Participants excluded based on communication problem, temporary residence, not willing to participate, and didn't complete questionnaire.

3.7 Determination of Sample Size

Sample size calculated based on formula of descriptive population proportion The quantitative sample size was calculated using a descriptive population proportion formula commonly applied in Biostatistics studies:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where:

n is size of sample; Z is 95% i.e. =1.96; p is the expected prevalence of perception of vaccination with maximum variability i.e. assumed 0.5 and marginal error 0.05.

Based on the assumptions sample size must be 385 approximately, for the enhancement of statistical stability and accounting non-response bias, sample size increased to 452.

25 participants for the qualitative data collection, were selected purposively on the basis of education, status of vaccination and patterns of perception

3.8 Technique of Sampling

A judgemental multistage stratified sampling technique adopted for this study.

Stage #1: Strata of Community

Categorization of communities were, semi urban and urban

Stage 2: Selection of Institution

Educational institutions, public gathering points and Healthcare canters, were purposively selected.

Stage 3: Selection of Respondents

Convenient sampling technique was used for the selection of respondents and for questionnaire distribution, similarly for qualitative interviews judgemental sampling technique was opted.

This integrating strategy elevated the diversity and facilitated inclusion of diverse level of respondents of vaccine hesitancy and confidence.

3.9 Instrument of Quantitative Section

Well-developed questionnaire was used after the extensive literature review related to attitude towards vaccine behavioral epistemology and communication of public health.

Questionnaires consist of six sections:

Section A Demographics of Respondents

Respondent demographics include gender, education, marital status, age occupation, income, and history of vaccination

Section B Vaccination Awareness

Measured by vaccination schedules awareness, herd behavior understanding, diseases preventable vaccination and the knowledge about benefits of vaccination

Section C Vaccine Effectiveness Perception

Assessment of the perception of respondents regarding infectious diseases protection, efficacy of vaccination and trust on doctors' recommendation.

Section D Fear and Hesitancy about Vaccine

It was measured by trust issues with the pharmaceutical companies, misinformation of social media and side effect fear and religious concerns mistrust.

Section E Institutional Trust and Healthcare Management

In this section management-oriented dimension introduces and examined the effectiveness of leadership perception, transparency of health-related communication, healthcare services satisfaction and during vaccination drive crisis management.

Section F. Behavioral Intentions

These sections include family member recommendation, booster program participation, and willingness to use vaccination in future. Responses were measured at five points Likert scale 1-strongly disagree to 5-strongly agree

3.10 Interview Guide

To capture the emotional experience and to capture deeper narratives regarding vaccination, an interview guide was designed.

It explored healthcare institutions trust, misconceptions and myths of community and personal experience of vaccination, impact of media on perceptions and recommendations to improve campaigns of vaccination.

3.11 Process of Instrument Development

The process of developing the instrument followed multiple stages and rigorous methodologies; literature review, extraction of constructs, preparing the questionnaire, validation of experts, pilot test, assessment of reliability and then the final version.

The instrument's content validity was tested by three experts in health care management and public health.

3.12 Pilot Testing

Pilot testing was done with the help of 50 respondents other than the main sample, it assessed language clarity, scale reliability, flow of questionnaire consistency of responses and evaluated time of completion. Based on feedback the instrument refined and improved the sequence.

3.13 Analysis of Reliability

With the help of coefficient of Cronbach's Alpha Internal consistency reliability was assessed (Table 1).

Table 1: Reliability

Variable	Cronbach's Alpha
Vaccination Awareness	0.85
Hesitancy of Vaccine	0.83
Trust on Institutions	0.87
Behavioral Intention	0.84
Overall Instrument	0.89

Indicted strong consistency.

3.14 Data Collection Procedure

Data was collected over 10 weeks. This process involved, permission of institutions, briefing of participants, acquisition of consent, distribution of questionnaire, scheduling interviews. Recording interview and note taking and securing data storage. Anonymity and confidentiality were maintained by the researcher throughout the process of research.

3.14.1 Ethical Considerations

Respondents of study were informed about rights to withdraw, confidentiality assurance, only academic use and voluntary participation. Personal identity was hidden

4. Data Analysis

4.1 Quantitative Data Analysis

Quantitative analysis interpreted and summarized the perceptions of community rather than causal relationships

4.1.1 BIO-Statistical Descriptive Analysis

The following statistical tools were used

4.1.2 Analysis of Frequency Distribution

Frequency distribution analysis was used to examine the respondent demographics, level of accepting vaccination, patterns of awareness, prevalence of hesitance. 65 % were vaccinated individuals, 25% were hesitant respondents and 10 % refused to vaccinate. Thus, finding show that acceptance of vaccination is high and very small segment refused to be vaccinated.

4.1.3 Measures of Central Tendency

Regarding the perception of vaccination mean scores were computed for the evaluation of average level of agreement.

Table 2: Central Tendency

Variable	Mean	SD
Vaccination Awareness	4.50	0.62
Trust on Institution	3.78	0.79
Side Effects fear	3.02	1.34
Intention of Future Vaccination	4.28	0.76

Mean scores data demonstrate that there is positive attitude towards the vaccination and moderate concern about side effect of vaccination (Table 2).

4.1.4 Standard Deviation Analysis

To examine the response variability standard deviation was used. High variability observed in the items associated with the long-term perceptions of vaccination safety, health care credibility of government and trust on social media. From the above table 2 it is evident that standard deviation of side effect fear is highest

4.1.5 Comparison of Urban and Semi-Urban Community

Mean response comparison of semi urban and urban community is given in the table #3

Table 3: Mean Response of Semi Urban and Urban Communities

Variable	Mean Urban Community	Mean Semi-Urban Community
Vaccination Awareness	4.50	3.75
Perception Effectiveness of Vaccine	4.07	3.67
Side Effects fear	3.02	3.42
Institutional Trust	3.78	3.19
Social Media Influence	3.51	3.99
Healthcare Communication Satisfaction	3.61	3.12
Future Vaccination Intention	4.28	3.89

Interpretation: The above results of table 3 indicates that there is a significant difference among the responses of semi urban and urban communities, urban community is well informed about the effectiveness of vaccination while semi urban community was more reluctant to use vaccination, and they were more concerned about the side effects of vaccination. Semi urban community is more confused regarding the effectiveness of public health services as compared to urban community. The comparative findings demonstrated noticeable differences between urban and semi-urban communities. Urban [participants have high level awareness, better understanding about effectiveness of vaccination and have confidence on the health care facilities of government. Thus we can associate it with the high level or better healthcare facilities more exposure of education, greater health care professional interaction and availability of verified information. This highlights marginalization of semi urban community, information gap, weak engagement of institutions and hesitancy of vaccination.

4.2 Factors Contributing Towards Vaccination Hesitancy

When the respondents were asked about the side effects fear 13.5% were disagree, 12.5 were neutral and 74% were agree. With respect to mistrust in pharmaceutical companies 22% were disagree, 20% were neutral and 58% were agree. When the researcher asked about the religious misconception, 39% were disagree, 18% were neutral, and 43% were agree. Regarding social media rumours, 69% were agree, 10% were neutral and 21% were disagree. With respect to the government communication gap 21% disagree, 15% neutral and 64% agree. Regarding long term effects on health, 17% disagree, 12 % neutral and 71% agree.

4.2.1 Interpretation

In the vaccination hesitancy, the biggest contributor was concerns based on fear. While social media spread of misinformation and long-term side effects concerns were particularly evident among semi-urban participants. Results indicated that miscommunication at the end of management also contributed significantly towards uncertainty and mistrust.

4.3 Importance Index Analysis

For the ranking of influential factors of community perceptions RII (Relative Importance Index) used (Table 4).

Table 4: Influential Factors Ranking

Factor	RII
Side Effects Fear	0.89
Influence Social Media	0.83
Trust on Institutions	0.80
Level of Awareness	0.78
Religious misconception	0.72
Influence of peer	0.68
Communication gap	0.65

4.4 Statistical Analysis of Perception about Management

Management dimension of health care integrated for the evaluation of institutional performance regarding the campaigns of vaccination

Table 5: Perceptions Related to Management of Healthcare

Statement	Mean	SD	Interpretation
Effective Communication of Healthcare Workers	3.82	0.78	Positive perceptions
Transparency of Vaccination Campaigns of Government	3.34	1.01	Moderate perceptions
Vaccination Awareness Supported by community Leaders	3.56	0.88	Moderate perceptions
High Rate of Response of Healthcare Institutions Regarding to Concerns	3.27	0.95	Moderate perceptions
Well Managed Vaccination Centers	3.74	0.82	Positive perceptions
Public Health Care Messages are Consistent	3.10	1.07	Perception about Weak Consistency

Interpretation: It is evident that the overall management of vaccination centres and operations was satisfactory, while the communication management is weak and recalls the need of consistency (Table 5).

It was emphasized by the participants that there must be transparent communication, accountability of leadership, effective strategies of awareness specific to community, and effective community engagement. Rapid spread of misinformation management. Thus, a successful program of vaccination is not only based on the availability of medical facilities but also based on communication, governance and trust.

4.5 Thematic Analysis

In this section, the researcher developed the themes and sub-themes with the coding process of the respondents' responses and then interpretation.

4.5.1 Theme 1: Vaccination Safety Anxiety and Fear

Table 6: Theme 1 Codes and Participant Responses

Sub-Themes	Codes	Statements of Respondents
Side Effects Fear	allergic reactions, weakness, and fever,	"Many people reported that severe weakness was caused by the vaccinations; that's why I am afraid of it."
Long-Term Effects fear	Infertility concerns, future illness	"We are not sure that after some time we may face different medical issues due to vaccination ."
Uncertainty about Medical Treatments	Lack of confidence in rapid development	"People are suspicious about vaccination because vaccinations were introduced rapidly without rigorous testing."

Interpretation: It reported by the respondents that they have health related anxiety and fear regarding vaccination (Table 6). Due to rumours, negative word of mouth and unverified sources of information about vaccination caused the fear among the semi urban community at high rate as compared to urban community. Thus, Semi-urban community exhibit more emotional concerns based on weak interaction with health care professionals.

4.5.2 Theme 2: Healthcare Institutional Trust

Table 7: Responses and Codes

Sub-Theme	Related Codes	Statements of Respondents
Doctors' Trust	professional advice medical expertise,	"On the recommendation of my doctor I accepted the vaccination ."
Credibility of Institution	Trust in the health care institution, confidence on Government	"We have more trust on particular hospitals rather than social media."
Transparency of Leadership	Accountability by communication,	"Both benefits and risks must be effectively communicated by authorities."

Interpretation: Vaccination acceptance significantly based on the trust of health care Institutions. The participants who had positive experience of healthcare were most likely to accept the vaccination programs (Table 7).

4.5.3 Theme 3: Social media Influence

Table 8: Responses and Codes

Sub-Theme	Codes	Statements of Respondents
Online Spread of Misinformation	conspiracy theories, Fake news,	"Massages on social media platforms like Instagram, whats-app created fear among families."
Influence of Peer	family and peer opinions, Pressure of community pressure,	"Mostly we follow the friends and family because of conformity effect."
Overloading of Information	Confusing and Conflicting reports.	"We are confused about the effectiveness of vaccination because different sources of health care provide different information"

Interpretation: Different Social media platforms significantly influence the perception of community by generating rumour and impulsive emotional reactions. Most of the respondents were unable to test and verify the credibility of medical misinformation and valid information (Table 8).

4.5.4 Theme #4: Gaps of Communication and Management of Healthcare

Table 9: Responses and Codes and Responses

Sub-Theme	Codes	Statements of Respondents
Weak Communication	Inconsistent and Unclear messaging	"Government frequently changes messages and confused people."
Lack of Community Outreach	deficient awareness programs and training	"In our community the Healthcare teams visited rarely."
Need for Community Awareness	Public dialogue and engagement of Local community,	"We trust more on local leaders because they explain the issues clearly."

Interpretation: It was highlighted by the respondents that the healthcare management is weak, the success of vaccination program relies heavily on the communication and effective management practices. A culture-sensitive and

decentralized model of awareness must be adopted for the success and effectiveness of vaccination policies (Table 9).

4.5.5 Theme 5: Biostatistical Evidence-Based Health Care Awareness and Decision-Making

Table 10: Responses and Codes

Sub-Theme	Related Codes	Statements of Respondents
Scientific Understanding	Trust in data and awareness	"prior to making a health care decision, I prefer scientific evidence. "
Rational Decision-Making	Comparing benefits and risks	"Vaccination is protection against severe illness."
Literacy of healthcare	Improvement of awareness	"People required educational and training sessions to understand usage and effectiveness vaccines properly."

Interpretation: Respondents emphasized the high rate of literacy regarding health care facilities and biostatistical interference for effective implementation of health care policies (Table 10). Now the people question the evidence and integrity of the health care management and require more training and awareness sessions supported by the statistical data for informed, evidence-based declension. This action will strengthen the confidence on the healthcare institutions and professionals. The results supported the bio-statistical integration with health care facilities to reduce mistrust and improve the vaccination program efficacy.

5. Discussion

The results of the research demonstrated that vaccination fear and anxiety develop a substantial barrier towards acceptance of vaccine among participants specifically in communities of semi-urban areas Erchick et al.(Erchick et al., 2022). Other key factors such as uncertainty, long term side effect fear, and short-term side effect fear regarding medical treatments, reflects the presence of psychological and emotional concerns regarding vaccination. Respondents of study mostly linked vaccines with fever, weakness, and allergic reactions showing perception regarding adverse effects. Likewise, concerns of public like future illness and infertility indicates fear regarding possible long-term consequences, irrespective of strong evidence to support such claim.

Results further suggests that uncertainty regarding rapid development of vaccine have negative effect on the confidence in medical treatments. They perceive that fast introduction of vaccine is sign of insufficient testing. It enhances reluctance and scepticism towards vaccination. These concerns are further reinforced by unverified sources of information, negative word of mouth, and rumours circulating withing communities. Results also show that semi-urban individuals show higher level of fear and anxiety as compared to individuals living in urban areas. This difference is mainly because of weaker interaction with healthcare professionals and limited access to credible health information. Therefore, respondents mentioned that they rely mainly on informal social networks that mostly elevate risk perception about vaccination.

Findings of study also revealed that trust of public on healthcare institutions play important role to shape acceptance of vaccination. Results also indicates that trust on institutions of healthcare play a key role to influence willingness of individuals to take part in programs of vaccination. Other different factors such as transparency of leadership, credibility of institutions, and trust on doctors shed light on different factors that affect decisions related to vaccination (Sutrisno et al., 2025). Respondents of study also emphasized the vital role of medical expertise and professional advice when making decisions related to vaccination. Several respondents mentioned that recommendations by the healthcare professionals enhance their level of confidence regarding effectiveness and safety vaccine, ultimately encouraging acceptance of vaccine.

Results suggests that healthcare professionals are considered as credible and reliable source of health information. Moreover, respondents also showed trust towards government supported health services and healthcare institutions as compared to information gathered from different social media channels. These perceptions showed importance of credibility of institution to minimize hesitancy and misinformation regarding vaccine. Results also show the vital role of leadership in developing public trust. Participants mentioned that effective communication regarding risks and benefits strengthen confidence and enhances accountability about programs of vaccination.

Results also revealed that social media is one of the vital forces to shape the perception of community regarding vaccination. Respondents of study mentioned platforms of social media as key space where information spread at a very fast pace, regardless of accuracy. Participants mentioned that they feel difficulty in distinguishing misinformation and credible health information. Results also revealed that participants get misinformation in the form of fake news and conspiracy theories through Instagram and WhatsApp. As a result of these messages uncertainty and gear is developed among individuals regarding vaccination (Islam et al., 2020).

Peer network is another aspect that generate information among communities. Respondents mentioned that vaccination decisions are mostly shaped by friends, family members, and broader community. The tendency to follow behaviors and opinions of trusted social contact show the role of with decision making related to health care. Most of the

individual rely on the experience of their social circle as compared to relying on the available evidence. Results also highlight that information overload also develop confusion among participants. When these individuals are exposed to conflicting reports from different sources, uncertainty regarding safety and effectiveness of vaccination is developed. As participants often go through contradictory messages related to vaccination, their level of confidence is diminished. The results mentioned that vaccination perception is influenced by social media by spreading misinformation that shape emotional responses of community.

Results of research showed that healthcare management and communication play an important role to influence response of public towards vaccination (de Koning et al., 2024). Respondents also emphasized the weakness of healthcare management structures and communication strategies contribute to reduce confidence, enhance mistrust, and confusion in initiatives of vaccination. Successful campaign of vaccination needs availability of vaccines along with mechanism to engage communities and communicate information. The major concern mentioned by participants was weak communication, specifically in the form of unclear and inconsistent messaging. Respondents also reported that regular changes in messages by the officials made it difficult for community members to accept information related to vaccination. Because of this inconsistency confidence of public is weakened and scepticism regarding recommendations of healthcare is increased.

Additionally, lack of outreach in community is one of key barrier in promoting vaccination. Respondents mentioned that teams of healthcare which visit their communities are rare and there are insufficient training activities and awareness programs. Therefore, most of individuals rely on information provided by informal sources. Results further show strong need to create awareness among community by engaging leaders of local community and generating public dialogues. Participants showed greater trust in leaders who provided clear information about health in a manner that is culturally relevant. Findings suggests that decentralized and culture sensitive approach regarding healthcare communication can improve effectiveness of vaccine policies, and enhance public understanding in semi-urban areas.

Results show that biostatistical evidence-based healthcare awareness programs plays a vital role to shape public confidence in healthcare intervention and vaccination decisions (Paul et al., 2021). Participants also indicated increased preference for scientific evidence and understanding in order to evaluate information regarding healthcare. Rather than relying only on social influences and the personal opinions, a number of respondents focused the vitality of trust in awareness and data for informed decision making.

Results also highlighted the importance of rational decision making, where respondents reported comparing risks and benefits of vaccination before making healthcare choices. Most of participants mentioned that they recognize vaccination as key measure against illness. It shows appreciation of scientific reasoning in health decisions. Moreover, literacy of healthcare is a key factor that influence acceptance of vaccine. Participations also stressed for training and educational sessions can improve the understanding or public regarding vaccine safety, effectiveness, and usage.

6. Limitations and Future Directions

Present research important insights into elements impacting decision making and perception of vaccination. Whereas, there are few limitations that must be mentioned. This research used qualitative research design, that allowed indepth exploration of experiences of respondents. Whereas, these results have limited generalizability in terms of broader population. Secondly, this research focused mainly on few communities. Therefore, the perception of vaccination maybe different in different cultural and socio-economic context. Thirdly, this research used judgmental sampling technique that has a number of limitations and difficult to follow.

In lights of above limitations, studies in future must incorporate more diverse and larger sampling by using quantitative research methodology. Moreover, comparative study between rural, semi urban, and urban population can provide more deeper understanding regarding perception of vaccination. Moreover, studies in future are advised to examine effectiveness of social media interactions, community outreach initiatives and awareness campaign. In the end, studies should use cluster sampling if they go for comparative analysis in terms of urban, rural and semi-urban population.

7. Contribution of Study

Present research contributes to literature by the identification of fiver themes that are interconnected and shape healthcare decision making. These themes include biostatistical evidence-based healthcare awareness, gaps while managing and communicating healthcare, social media influence, healthcare institutional trust, and vaccination safety fear and anxiety. The research enhances understanding of existing literature by mentioning that vaccination decisions are impacted by institutional, informal, social, and psychological factors operating in different communities. Furthermore, studies provide practical guidance to policymakers and healthcare managers. Findings highlight that incorporation of

biostatistical evidence into health campaigns may enhance vaccination program effectiveness, support informed decisions, and reduce misinformation. In the end, these findings can be used by academicians for their future research regarding vaccination acceptance as well.

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