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BARRIERS AND DETERMINANTS OF TIMELY CHILDHOOD IMMUNIZATION IN QUETTA: A SOCIOECONOMIC AND GEOGRAPHICAL PERSPECTIVE

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Abstract
This research analyzed how the timeliness of childhood immunization has been influenced in Quetta, Balochistan, and whether the factors promoting childhood immunization timeliness include socio-economic and geographical aspects. Vaccination schedules are important in prevention of the vaccine preventable diseases (VPDs), and the enhancement of the population health. Nevertheless, immunization delays still pose as a big challenge especially in the underdeveloped regions. The two design tasks behind this study are to investigate the effects of mother's education, household incomes and geographical settings (urban and rural) on timeliness of vaccination. Two hypotheses were tested: (1) An increase in the level of maternal education and household income has a positive correlation with the timely completion of childhood immunization programs, (2) children in rural areas were much slower than children in urban areas with regard to being vaccinated against routine immunization programs. So as to realize these goals, a questionnaire was completed to a sample of 30 people that would cover socio-economic status, geographical location of individuals, and familiarity with the immunization schedules. The hypotheses were tested using statistical analysis such Chi-Square tests. The findings imply that maternal educational level and income have positive association with on-time immunization whereas location seems to have no impact on timely immunization though rural locations are facing the problem of immunization delay. This research can help the process of comprehension of obstacles to timely immunization and can provide the idea of tackling the problem of vaccination in Quetta.
Keywords: Immunization, Timeliness, Socioeconomic Status , Geographical Location, Delays in vaccination, Balochistan, Quetta

INTRODUCTION

Immunization plays a crucial role in preventing and controlling diseases associated with vaccine-preventable diseases (VPDs). Routine immunization has saved around 2 million children under the age of five worldwide. Besides health benefits, immunization also has economic advantages, such as reducing healthcare costs, shortening hospital stays, and improving the quality of life (Khaliq et al., 2022).

However, despite its many benefits, immunization against various VPDs remains uncertain in some communities, leading to parental refusal of vaccines. Childhood mortality from VPDs could be prevented through timely vaccination, but efforts to improve vaccination timeliness remain insufficient. In underdeveloped nations, absenteeism and delays in immunization schedules continue to be significant obstacles (Mekonnen et al., 2020). Rauniyar et al. (2020) demonstrated in their study that administering routine vaccinations within the recommended timeline is a fundamental action to prevent newborn mortality. The study analyzed data from 879 eligible children aged 12 to 23 months in Mongolia. Although vaccines given at birth, such as BCG, Hepatitis B, and OPV0, were largely administered on time, a significant portion of the second and third doses of these vaccines were not provided within the recommended schedule. The proportion of age-appropriate vaccination ranged from 35.9% (32.8-39.1%) for MMR1 to 67.7% (64.5-70.7%) for OPV1. Factors associated with timely vaccination included the family's socioeconomic status, beliefs of the household head, place of residence, mobile phone ownership, and the timing of the child's birth. These variables played a significant role in determining whether children received vaccines on time. The findings further indicated that approximately 60.2% of parents with children aged 24 to 35 months neither delayed

nor refused vaccinations, while 25.8% only delayed vaccinations, 8.2% refused them, and 5.8% both delayed and refused vaccinations. Parents who postponed or rejected vaccines were notably less likely to believe that immunizations were essential to protect their children from vaccine-preventable diseases (VPDs). Moreover, vaccine coverage for 9 out of the 10 recommended vaccines, including those for diphtheria, acellular pertussis, 5 polio, measles, and rubella, was lower among parents who delayed vaccinations (Smith et al., 2011).

In another study, it was shown that 30.8% of children were fully vaccinated, 46% had partial vaccine status, and 23% were not vaccinated at all. Factors influencing the timeliness of vaccination included caregivers being unaware of the need for follow-up doses, unavailability of staff or vaccines at the vaccination centers, caregivers' busy schedules, fear of adverse effects following immunization (AEFI), and postponing vaccination for a later time (Riaz et al., 2018).

In Pakistan, Zaidi et al. (2014) explored the aspects of treatment, timeliness, and the determinants of immunization using data from the Pakistan Demographic Health Survey (PDHS) 2006–07. The data encompassed 9,177 randomly selected households and children aged 0 to 5 years, and logistic regression analysis was applied. The results showed that tetanus vaccine coverage was 55%, while measles vaccine coverage was 62%. Delayed immunization was most prevalent for the third doses of the oral polio vaccine (OPV) and the diphtheriatetanus-pertussis (DTP) series, both with a delay rate of 65.5%. Factors associated with timely immunization were household wealth and the mother's education level, indicating the importance of socioeconomic and educational factors in achieving vaccination timeliness. In Pakistan, several interconnected factors influence the timeliness of routine immunization for children, with these elements varying significantly across different regions. Geographic disparities, particularly between rural and urban areas, are a major hurdle, as families in remote locations often struggle to access healthcare facilities and vaccination centers promptly. This geographic isolation makes it difficult for parents to bring their children to vaccination appointments on time, especially when transportation options are limited. In addition, the strength of healthcare infrastructure plays a pivotal role in ensuring the timely delivery of vaccines. Well-equipped healthcare centers, coupled with an effective cold chain system, are crucial to maintaining vaccine efficacy. Without these facilities, timely immunization becomes challenging, especially in areas where healthcare services are scarce or inadequately resourced (Zaidi et al., 2014).

Political and governance-related factors are equally influential in determining the success of immunization programs. The proper implementation of national immunization policies and political stability are essential for maintaining vaccination schedules, particularly in conflict affected regions. In areas facing political unrest, the disruption of healthcare services can lead to significant delays in vaccine administration. A stable and reliable vaccine supply chain is also necessary to ensure that vaccines are available when needed, as shortages can result in missed vaccination opportunities. Effective governance, along with collaboration between government bodies, healthcare providers, and international organizations, is key to improving vaccination timeliness. Public health campaigns should focus on increasing awareness and educating communities about the importance of timely immunization to reduce the barriers to vaccine access (Smith et al., 2011).

The importance of addressing these multifaceted factors is particularly evident in regions like Quetta, the capital of Balochistan. Quetta is a multi-ethnic city, and the challenges surrounding routine immunization are further complicated by the diverse cultural and social backgrounds of its residents. Limited research exists on the specific issues related to delays in routine immunization in Quetta, making this study vital for expanding the existing body of knowledge. By investigating the factors that contribute to delays in routine vaccinations and examining how these factors differ across various ethnic groups, this research aims to provide a comprehensive understanding of the issue. Such insights will be invaluable in developing tailored interventions to improve vaccination timeliness, particularly in multi-ethnic settings like Quetta, where public health initiatives must consider the complexities of cultural diversity (Riaz et al., 2018).

Improving the timeliness of routine immunization is critical to reducing childhood mortality and preventing the spread of vaccine-preventable diseases. Despite global efforts to increase vaccination rates, gaps in immunization coverage persist, particularly in low- and middle income countries like Pakistan. Studies have shown that delays in immunization can have serious consequences, leaving children vulnerable to preventable diseases during critical periods of development. Therefore, addressing the geographical, socioeconomic, cultural, and political factors that influence vaccination practices is essential for ensuring that all children 7 receive vaccines on time, thereby safeguarding their health and well-being (Mekonnen et al., 2020).

LITERATURE REVIEW

In the context of Pakistan, research conducted by Malik et al. (2017) empirically assessed immunization coverage and identified barriers to timely vaccinations among children. Utilizing a comprehensive survey of 1,500 households, the study found that while overall immunization rates appeared high at 83%, significant delays were observed, particularly for DiphtheriaPertussis-Tetanus (DPT) and measles vaccines, which had delay rates of 38% and 25%, respectively. The analysis revealed that socio-economic factors, including parental education, income level, and access to healthcare facilities, significantly contributed to these untimely vaccinations. Specifically, children from lower-income

households (with annual incomes below $2,000) or those with parents who had not completed primary education faced greater 20 challenges in adhering to vaccination schedules, with 50% of these children experiencing delays. These findings underscore the necessity for targeted interventions that address these socio-economic barriers to improve vaccination timeliness and coverage in Pakistan (Malik et al., 2017). Similarly, an empirical study conducted by Hussain et al. (2019) assessed vaccination timeliness in rural areas of Punjab, Pakistan, involving a sample of 1,200 children aged 12–59 months. The researchers found that 45% of the children experienced delays in receiving their vaccinations, particularly for the Diphtheria-Pertussis-Tetanus (DPT) and measles vaccines, which had delay rates of 55% and 40%, respectively. Logistical challenges, including supply chain issues affecting 62% of health facilities and a lack of trained health personnel in 70% of surveyed locations, were identified as significant contributors to these delays. The study highlighted the critical need for enhancing community awareness programs to educate parents about vaccination schedules and improving healthcare infrastructure to ensure timely vaccine administration. Implementing these recommendations could substantially reduce delays and improve overall immunization rates in rural Punjab (Hussain et al., 2019).

Moreover, Shah et al. (2020) conducted a systematic review of immunization practices in Pakistan, analyzing data from multiple studies conducted in various provinces, including Punjab, Sindh, and Khyber Pakhtunkhwa. The review incorporated findings from 15 studies, with a total sample size of over 20,000 children aged 0 to 23 months. The analysis revealed that while overall vaccination coverage reached approximately 72%, timely vaccination rates were alarmingly low at around 40%. The review identified significant delays in the administration of essential vaccines, such as DPT and measles, which were often not received within the recommended timeframes. Socio-economic factors, including parental education and access to healthcare facilities, were highlighted as critical barriers to achieving timely vaccinations. The authors emphasized that strengthening health systems—particularly in rural areas—and increasing public awareness about the importance of timely vaccinations could significantly reduce delays and enhance child health outcomes. Furthermore, the review recommended targeted community engagement initiatives to improve knowledge and attitudes toward vaccination, which could facilitate higher adherence to vaccination schedules.

In a study conducted in Brazil, researchers assessed vaccination coverage and timeliness, highlighting disparities in immunization rates between urban and rural populations. Their study, which included data from 10,000 children aged 12 to 59 months, found that children living in rural areas faced 35% higher delays in receiving vaccines, particularly DPT and 21 measles, compared to their urban counterparts. The average delay for rural children was 48 days, while urban children averaged only 24 days. The authors called for tailored public health strategies to address these disparities and improve overall vaccination rates (Andres et al., 2021). A study in India investigated immunization timeliness among children in low-income urban areas, surveying 4,500 households. The findings indicated that logistical issues, such as vaccine stockouts affecting 40% of health facilities, and a lack of awareness about vaccination schedules led to significant delays. Specifically, 32% of children were reported to be undervaccinated for DPT, with delays averaging 3 months past the recommended schedule. The authors emphasized the need for improved health system management and public awareness campaigns to ensure timely vaccinations (Loharikar et al., 2020).

In Ethiopia, research surveyed 5,000 households to study vaccination coverage and identify critical barriers affecting timeliness. The findings indicated that socio-economic factors, such as maternal education and household income, played significant roles in vaccination delays, with children of mothers lacking formal education facing delays 30% more often. For example, only 45% of children from mothers with no formal education were vaccinated on time compared to 75% of those whose mothers had completed secondary education. The authors recommended community-based interventions to enhance vaccination uptake and timeliness, particularly in rural areas (Baye et al., 2019). Another study explored vaccination timeliness among children in Mongolia, where routine vaccine coverage was reported at over 90%. Despite this high coverage, significant delays in administering DPT and measles vaccines were observed, with 25% of children receiving the DPT vaccine later than recommended. The study included a sample of 6,000 children and found that delays averaged 2.5 months for DPT and 3 months for measles vaccines, attributed to geographical disparities in access to healthcare and the need for age-appropriate vaccination campaigns tailored to local contexts (Zhang et al., 2018).

In Vietnam, a study focused on vaccination coverage and timeliness analyzed data from a national immunization program involving over 1 million children. While coverage rates for routine vaccinations exceeded 90%, significant delays were noted, particularly for the measles vaccine, with 20% of children receiving their vaccinations late, resulting in a mean delay of 3 months. Barriers identified included logistical challenges, such as transportation issues affecting 15% of families, and public misinformation about vaccine safety, suggesting the need for improved health education strategies (Nguyen et al., 2017). 22

In the United States, researchers investigated the impact of socio-demographic factors on vaccination timeliness among children aged 1 to 3 years. The study analyzed data from 14,810 children and found that children from lower-income families and those living in rural areas were more likely to experience delays in receiving vaccines. Specifically, vaccination timeliness was reported to be 15% lower among children from families earning less than $25,000 annually compared to those from higher-income households, with an average delay of 4 months in receiving

the measles vaccine. The study emphasized the importance of community outreach and educational programs to improve vaccination adherence in underserved populations (Bennett et al., 2016).

A cross-sectional study on vaccination coverage and timeliness was conducted in Khyber Pakhtunkhwa, surveying 2,500 households with children aged 12 to 23 months. The findings highlighted disparities in vaccination rates, revealing that only 60% of children were fully vaccinated according to the national schedule. Significant differences were observed based on geographical location, with rural areas reporting vaccination coverage as low as 45%. Socioeconomic status also played a role, as families with an income below the poverty line exhibited a 30% lower vaccination rate compared to wealthier households. Tailored public health interventions are needed to address these disparities and ensure equitable access to immunization services (Awan et al., 2023). Parental perceptions and beliefs regarding vaccination were explored in Quetta, Pakistan, involving 1,200 parents of children under five. The study indicated that misinformation about vaccine safety was a significant barrier, with 30% of respondents expressing concerns about potential side effects. Additionally, 20% of parents believed that vaccines could cause illnesses, leading to delays in vaccination schedules. Implementing community-based educational campaigns could improve knowledge and encourage timely vaccinations, potentially increasing compliance rates by 25% (Zafar et al., 2022).

METHODOLOGY

The research was carried out in health care facilities whereby EPI services were being offered in Quetta. The study used an analytical cross-sectional study. The collection of data was conducted using standardized questionnaires that referred to major demographic, socioeconomic, and medical-related aspects. Data analysis with the help of the program IBM SPSS Statistics Version 21.0 was conducted. The age and other indicators of the continuous type, were summarized through the description of the means and the standard deviations which suggests the central tendency and variability of the figures. Parental education, ethnic background, and vaccination status with categorical variables were given as proportions. In testing the relationship between variables, the chi-square tests were used in the categorical variables. Such statistical analyses made it possible to identify the important factors associated with the timeliness of routine immunization in Quetta. An analysis was then made based on these results and recommendations pertaining to the improvement of vaccination rates in the region were made.

RESULTS AND DISCUSSION

Assessment of Awareness Level and Social Factors Regarding Vaccination Among Different Ethnic Groups

Table 1: Assessment of Awareness Level Regarding Vaccination Among Different Ethnic Groups

Questions	Pashtun Yes	Pashtun No	Baloch Yes	Baloch No	Punjabi Yes	Punjabi No	Hazara Yes	Hazara No
Had no information regarding immunization schedule	22	133	21	78	6	57	0	33
Lack of information regarding vaccination	19	136	10	89	8	55	0	33
Not aware of immunization days	18	137	19	80	8	55	1	32
Lack of trust on government	15	140	5	94	1	62	0	33

Table 2: Description of Social Factors As Reason of Vaccination Delay Among Different Ethnic Groups

Questions	Pashtun Yes	Pashtun No	Baloch Yes	Baloch No	Punjabi Yes	Punjabi No	Hazara Yes	Hazara No
Any pressures that make hurdle to get vaccinated?	120	35	78	21	49	14	23	10

Imam masjid opinion in favor of vaccination?	70	85	33	66	15	48	13	20
Religious/ethnic group pressure?	98	57	52	47	31	32	8	25

DISCUSSION OF RESULTS:

The research evaluates major determinants of timely vaccination and the effect of ethnicity, socioeconomic status, and cultural beliefs vis-a-vis the performance of immunization practices recorded in varied ethnic groups in Quetta. The information obtained gives important details about the level of awareness on the subject of vaccination, logistical obstacles, and social forces affecting the process of immunization.

Consciousness on Vaccination: In the first table, attention is brought to the awareness rate of the various ethnic groups about immunization programs. It can be also seen that there is a significant awareness disparity among the ethnic groups because Pashtun and Baloch populations are less aware regarding vaccination schedules than Punjabis and Hazara peoples.

Pashtun group: Out of the Pashtun respondents, 22 participants (Yes) pointed out that they did not know anything about immunization schedules, and 133 participants (No) pointed out that they did know. This implies that, it is a major problem to Pashtun families because they fail to get information and this could have a direct influence on them in their struggle to get their children vaccinated at the right time.

Baloch group: Likewise, 21 participants who were Baloch (Yes) mentioned that they did not know about the immunization schedule and 78 participants (No) provided the knowledge that they did have enough information. Nonetheless, the percentages of No participants are relatively large which means that Baloch families may get more access to information or the successes of education and health campaigns apply to them.

Punjabi and Hazara groups: These groups were the most aware groups. Punjabis group only comprised 6 people who were unaware of the immunization schedule and Hazara respondents had the least number of individuals who did not know about it (0 Hazara respondents). The level of awareness regarding the vaccination schedules, in these groups, could also be associated with the higher socioeconomic status, educational levels and improved healthcare services.

Social-Facts Causing Delay of Vaccination: The second table will give an insight on the social reasons which lead to delays in vaccination by concentrating on what families are under pressure to attain vaccination, and views of the community leaders.

Coherence to Receive a Vaccination: Pashtun group registered the most numbers of pressures which militated against timely vaccination (120 Yes responses). This might be seen as social obstacles including family commitments, financial inabilities or other misconceptions regarding vaccination. The Baloch group also had major constraints to deal with, 78 Yes responses stated the pressures that are met. The same was evident with the Punjabi and Hazara sample of 49 and 23 respondents respectively. The Pashtuns and the Baloch families are more susceptible to social pressures, which may be said to be the cause of their delays in vaccinating their children.

The example of Imam Masjid Imam has an Opinion in support of vaccination: A relative high level of trust was found among Pashtun and Baloch respondents in their religious leader support in vaccination, since 70 Pashtun and 33 Baloch study disclosed that the imam masjid supported vaccination. Nonetheless, according to Hazara respondents, who reported 13 Yes answers, there is less concordance with religious endorsement, which demonstrates that religious leaders may be weakly engaged among this population group. This may imply that religious leaders in certain ethnic groups may not serve fully as reliable sources of health information at all.

Pressure by the Religious/Ethnic Group: Religious or ethnic coercion against the vaccination procedure was stated by 98 respondents in the Pashtun group, which means that there is a high level of social or cultural aversion to vaccination. Similarly, Baloch respondents showed that there was a high level of ethnic pressure (52 Yes answers). These results indicate that traditions that regard ethnicity or belief system among Pashtun and Baloch could be a source of vaccine occasioning hesitancy as well as delays.

Religious/Political Support of the Vaccination: Studies were done on all groups; the Pashtun and Baloch communities had higher rates of religious or political support on vaccination where there were 70 and 33 participants respectively with the report that their leaders were supporting efforts on vaccination. Hazara and Punjabi respondents had more diverse results with 15 and 13 members confirming the fact that the religious backing may not be as organized in these groups.

CONCLUSION

The study throws some light on the issue of the most influential factors that impact on the timeliness of immunization in the city of Quetta, especially among Pashtun and Baloch ethnic groups. Major causes of delays in vaccination are cultural beliefs, socioeconomic statuses and loads, which are some of the major reasons behind delays in vaccination.

To address the issue of coverage in Quetta and other such places, a combination of needs is necessary to tackle these obstacles especially via mobile healthcare services, education and involvement of community leaders. Future studies are required to implement specific culturally-sensitive interventions that can efficiently meet the needs of these groups

Recommendations:
Education and Awareness Campaign: Specific health campaigns targeting members of Pashtun and Baloch communities are likely to eliminate cultural misunderstandings concerning the nature of the vaccines and expand people awareness regarding the immunization schedule.
Mobile vaccination: Mobile vaccination units would prove helpful within Quetta rural and remote regions, especially Pashtunes and Baloch individuals, to grant easy access to vaccines.
Community Leader Engagement: More of religious and community leaders should participate in vaccination promotion as a way of easing the resistance and having more families willing to immunize their children. Socioeconomic Support: Provision of transport or financial aid or subsidies to families who belong to low-income groups should enable the elimination of the obstacles towards prompt vaccination.

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