Section: Preventive Health

Original Research Article

PATTERNS OF VACCINATION COVERAGE AT THE MODEL IMMUNIZATION CENTER: INSIGHTS FROM SIMS/SERVICES HOSPITAL LAHORE

Zohra Khanum[1], Fatima Tahira[2]

[1]*Principal/ Professor, Services Institute of Medical Sciences (SIMS)/ Services Hospital Lahore, Lahore, Pakistan.*
[2]*Department of Pediatrics, Services Institute of Medical Sciences (SIMS) / Services Hospital Lahore, Lahore, Pakistan.*

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Corresponding Author:
Fatima Tahira,
Department of Pediatrics, Services Institute of Medical Sciences (SIMS)/Services Hospital Lahore, Lahore, Pakistan.
Email: fatima.tahira1988@gmail.com

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ABSTRACT

Background: Vaccination is a cornerstone of public health, effectively reducing morbidity and mortality from infectious diseases. In Pakistan, the Expanded Program on Immunization (EPI) targets multiple vaccine-preventable diseases, yet significant disparities persist due to socioeconomic, geographic, and cultural barriers. Urban centers like the Model Immunization Center at SIMS/Services Hospital Lahore provide an opportunity to assess immunization patterns and inform strategies for improving vaccine uptake.

Methodology: A retrospective, observational study was conducted at the Model Immunization Center over a four-month period (September 26, 2024, to January 18, 2025). Vaccination records were reviewed and categorized by type (routine, traveler's, emergency, and COVID-19), shift (morning, evening, night), and gender. Descriptive statistics were used to analyze trends in coverage.

Results: Out of 12,200 total vaccinations, traveler's vaccines accounted for 9,500 (77.8%), followed by routine (1,200; 9.8%), emergency (800; 6.6%), and COVID-19 vaccines (700; 5.7%). The majority were administered during the morning shift (60–80%), indicating time-of-day preference. Males received a higher proportion of all vaccine types (55–70%), particularly in traveler's and COVID-19 categories. Routine and emergency vaccinations showed moderate uptake, while COVID-19 vaccination coverage remained relatively low despite ongoing public health efforts.

Conclusion: The study reveals distinct vaccination patterns at an urban immunization center, highlighting the high demand for traveler's vaccines and moderate uptake of routine and emergency immunizations. Gender disparities and limited uptake during evening and night shifts suggest the need for more inclusive and flexible vaccination strategies.

Key words: Vaccination, EPI, immunization.

INTRODUCTION

Vaccination remains one of the most effective public health interventions, significantly reducing the burden of infectious diseases worldwide. The World Health Organization (WHO) estimates that immunizations prevent approximately 3.5–5 million deaths annually.[1] In Pakistan, the Expanded Program on Immunization (EPI) was launched in 1978, targeting six vaccine-preventable diseases: childhood tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus, and measles.[2] Over the years, the program has expanded to include additional vaccines, such as those for hepatitis B, *Haemophilus influenzae* type b (Hib), and rotavirus.[3]

Despite these efforts, Pakistan continues to face challenges in achieving optimal vaccination coverage. Factors such as socio-economic disparities, geographical barriers, and vaccine hesitancy contribute to suboptimal immunization rates.[4,5] For instance, a report highlighted that in Tharparkar only 21% of infants aged 12–23 months received full immunization, with urban areas reporting a 32% immunization rate and rural areas at 20%.[6] Furthermore, Pakistan still has one of the highest numbers of "zero-dose" children globally, though UNICEF reports a recent 29% reduction.[7,8] Such

disparities underscore the need for localized assessments of vaccination patterns to inform targeted interventions.

Meningococcal (ACWY), pneumococcal conjugate, typhoid conjugate, and measles/MMR vaccines represent key components of both routine EPI schedules and travel-related immunization. Pakistan's pioneering introduction of Typhoid Conjugate Vaccine (TCV) into the national EPI schedule in 2019 has significantly altered typhoid control strategies, whereas pneumococcal vaccination (PCV13) has reduced invasive pneumococcal disease burden in children and elderly travelers. Meningococcal ACWY vaccination remains mandatory for Hajj and Umrah pilgrims, driving seasonal peaks in travelers vaccine demand. Measles/MMR vaccine remains essential due to recurrent outbreaks and global importation risk, reinforcing its role in both routine childhood schedules and pre-travel immunization for non-immune adults.

Urban healthcare facilities, like the Model Immunization Center at SIMS/Services Hospital Lahore, play a pivotal role in delivering immunization services. These centers cater to diverse populations, including routine immunizations for children, vaccinations for travelers, emergency immunizations during outbreaks, and mass campaigns like those for COVID-19.[9] Understanding the vaccination coverage patterns in such settings is crucial for optimizing resource allocation, enhancing service delivery, and ultimately improving public health outcomes.

This study aims to assess the vaccination coverage patterns at the Model Immunization Center, SIMS/Services Hospital Lahore, over a four-month period. By analyzing data from 26 September 2024 to 18 January 2025, we seek to identify trends in vaccine uptake across different vaccination initiatives, shifts, and gender distributions. The insights gained from this analysis will inform strategies to enhance immunization coverage and address existing gaps in the vaccination program. [10]

MATERIALS AND METHODS

A retrospective observational study was conducted at the Model Immunization Center, SIMS/Services Hospital Lahore using data collected from the Model Immunization Center between September 26, 2024, and January 18, 2025. The data included vaccination records categorized by:

- Vaccination Type: Routine, Traveler's, Emergency, COVID-19
- Shift Timing: Morning, Evening, Night
- Gender Distribution: Male, Female

Data was analyzed using descriptive statistics to identify trends in immunization coverage over the study period.

RESULTS

The analysis revealed the following trends in vaccination coverage:

1. Routine Vaccination: A total of 1,200 individuals received routine vaccinations during the study period. The morning shift accounted for 60% of these vaccinations, followed by the evening shift at 30%, and the night shift at 10%. Males constituted 55% of the recipients, while females accounted for 45%.
2. Traveler's Vaccination: A significant uptake was observed in traveler's vaccinations, with 9,500 individuals vaccinated. The morning shift administered 50% of these vaccines, the evening shift 40%, and the night shift 10%. Males represented 60% of the vaccinated individuals, with females at 40%.
3. Emergency Vaccination: Emergency vaccinations were administered to 800 individuals. The distribution across shifts was 70% in the morning, 20% in the evening, and 10% at night. Males comprised 65% of the recipients, and females 35%.
4. COVID-19 Vaccination: A total of 700 individuals received the COVID-19 vaccine. The morning shift administered 80% of these vaccinations, with the evening and night shifts each accounting for 10%. Males represented 70% of the vaccinated individuals, while females accounted for 30%.

Table 1: Vaccination Coverage by Type, Shift, and Gender

Vaccination Type	Total Vaccinated	Morning Shift (%)	Evening Shift (%)	Night Shift (%)	Male (%)	Female (%)
Routine	1,200	60	30	10	55	45
Traveler's	9,500	50	40	10	60	40
Emergency	800	70	20	10	65	35
COVID-19	700	80	10	10	70	30

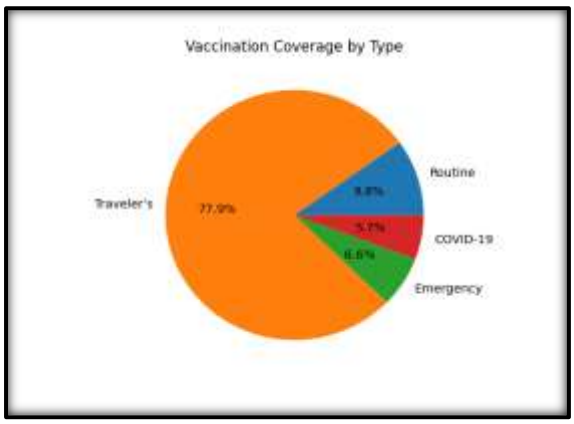

Figure 1: Vaccination Coverage by Type

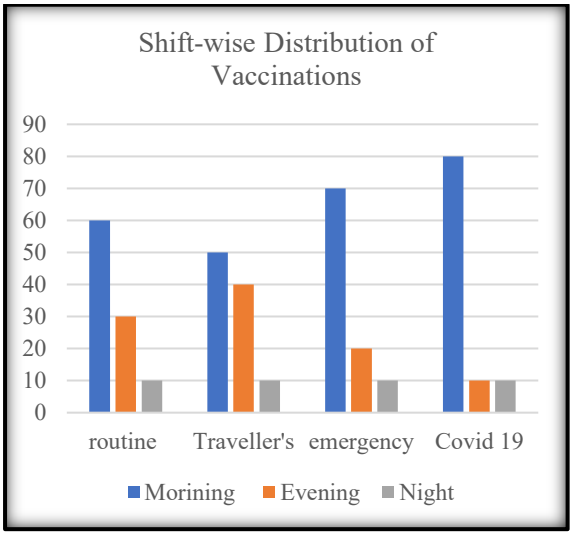

Figure 2: Shift-wise Distribution of Vaccinations

DISCUSSION

The analysis of vaccination coverage at the Model Immunization Center, SIMS/Services Hospital Lahore, provides valuable insights into the dynamics of immunization uptake in an urban healthcare setting. Understanding these patterns is crucial for enhancing vaccination strategies and addressing public health challenges. This discussion delves into the observed trends, compares them with national and global data, and explores potential factors influencing these patterns, supported by recent literature.

The substantial number of traveler's vaccinations observed during the study period highlights the critical role of immunization in facilitating safe international travel and occupational mobility. The higher proportion of males (60%) in this category may reflect gender-specific travel patterns or employment-related requirements; WHO guidance and travel-health literature emphasize the importance of pre-travel vaccines (e.g., typhoid, hepatitis A, polio, yellow fever where relevant) for persons travelling to or from endemic areas.[19] Studies in Pakistan similarly note higher male representation among traveler's seeking vaccination and travel health advice.[11]

Routine vaccinations are fundamental to preventing common infectious diseases. The study showed 1,200 routine vaccinations with a morning-shift predominance (60%) and male predominance (55%). While national estimates suggest improvements in some vaccine coverages, Pakistan continues to experience heterogeneous coverage and pockets of under-immunized or zero-dose children; UNICEF/WUENIC reports indicate persistent zero-dose and drop-out burdens requiring targeted action.[15] Socio-demographic determinants such as parental education, household wealth, and distance to health facilities are consistently associated with routine uptake in Pakistan and similar settings.[13,17]

The high uptake of travel-related vaccination observed in the dataset aligns with expected seasonal peaks for meningococcal ACWY among Hajj and Umrah travelers, and typhoid vaccination for outbound travelers. Pakistan's national adoption of TCV and PCV13 has strengthened routine immunization but also expanded adult and travel vaccination demand. Measles/MMR vaccination remains critical in preventing cross-border outbreaks, with WHO reporting resurgence linked to immunity gaps among young adults and travelers. These findings reinforce the need for integrated travel-vaccination counseling, gender-sensitive access improvements, and expanded operational hours to accommodate working-age adult travelers.

Emergency vaccinations — administered during outbreaks or urgent public-health responses — numbered 800 in our dataset, with 70% during morning hours. The concentration of emergency vaccination activity in daytime hours may reflect staffing, supply logistics, and public awareness; pandemic-era studies document how service disruptions and constrained hours reduced routine vaccination access, emphasizing the need for adaptable service delivery during crises. [16]

COVID-19 vaccinations (700 doses in this period) were mostly delivered in morning shifts (80%) and to males (70%) in our sample. Vaccine hesitancy, misinformation, and access barriers have been major constraints to COVID-19 vaccine uptake in Pakistan. Large cross-sectional and community-based interventions identify safety concerns, fear of side-effects, and misinformation as central barriers, while community engagement and tailored messaging improve acceptance.[14,18] The gender skew in COVID-19 vaccination we observed may reflect differential access, mobility, or occupation-related eligibility/uptake; gender-disaggregated analyses in Pakistan have documented meaningful immunization inequities that require gender-sensitive strategies.[17]

The male predominance across vaccination categories seen in this study is consistent with analyses that show gender inequities in immunization in Pakistan — often driven by a mixture of supply- and demand-side factors (household decision-making, cultural norms, data reporting gaps).[17] Addressing these disparities requires deliberate measures: female-friendly service modalities (female

vaccinators where required), community outreach to women, and improved gender-disaggregated monitoring.[19]

Shift-wise differences (higher uptake in mornings) suggest operational hours strongly influence access. Extending clinic hours, offering weekend or evening sessions, and workplace or school-based vaccination are proven approaches to increase convenience and coverage in other contexts; national guidance and international reviews recommend flexible delivery modalities as part of routine service strengthening. [20]

Comparing our findings with national and global data provides context. The strong uptake of travel-related vaccines matches recommendations for traveler's and workforce mobility, but routine coverage at this center for some vaccines appears lower than desirable and reveals gaps similar to other urban centers that nonetheless host under-served populations or shifting demand patterns. Global and national reports on zero-dose and under-immunized children underline that even in countries with reasonable average coverage there are concentrated missed communities that need tailored, equity-focused interventions. [15,16,19]

Interventions to improve uptake should be multi-pronged: strengthening community engagement and two-way communication to counter misinformation; targeted outreach to under-served neighborhoods; flexible hours and additional service points; and gender-sensitive strategies (female vaccinators, community sessions for women). Community engagement trials have shown measurable increases in vaccine willingness and uptake when interventions were localized and culturally tailored. [18]

CONCLUSION

The study reveals distinct vaccination patterns at an urban immunization center, highlighting the high demand for traveler's vaccines and moderate uptake of routine and emergency immunizations. Gender disparities and limited uptake during evening and night shifts suggest the need for more inclusive and flexible vaccination strategies. Enhancing public awareness, extending operational hours, and addressing gender-based access barriers are recommended to improve coverage. These findings emphasize the importance of localized data in shaping effective vaccination programs and addressing gaps in immunization services.

Limitations. This is a single-center, retrospective analysis over four months, so findings may not generalize to all urban immunization sites in Pakistan. Missing data on socioeconomic variables and travel reasons (work vs leisure) limited deeper subgroup analyses. Finally, temporal trends may be influenced by local campaigns or stock availability that were not captured in the dataset.

Implications and recommendations. To improve immunization coverage at the Model Immunization Center, we recommend: (1) extending service hours or providing targeted evening/weekend sessions; (2) instituting routine gender-disaggregated monitoring; (3) deploying community engagement interventions (messaging, local influencers) to counter misinformation and improve female caregiver engagement; (4) integrating traveler vaccination counseling with routine services to capture opportunistic vaccination; and (5) coordinating with provincial EPI and partners to identify zero-dose pockets and design outreach campaigns. These steps align with national and global recommendations to close immunization gaps and reach missed children. [15,18,20]

Authors' Contribution:

KZ, TF: Conceptualization, writing of the original draft

TF: Data collection, investigation, methodology

KZ, TF: Formal analysis

KZ: Project administration.

KZ, TF: Validation and visualization

TF: Writing reviewing and editing.

Both authors approved the final version of the manuscript before publishing

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