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**Original Research Article**

# Trends and Gender Patterns of Expanded Program on Immunization (EPI) Vaccination among Children in Dhaka, Bangladesh

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**Abstract:** ***Background:*** The Expanded Program on Immunization (EPI) protects children from vaccine-preventable diseases, thus averting childhood death and disease. After Bangladesh implemented the Expanded Program on Immunization in 1979, they made advancements in vaccine delivery, yet urban centers, specifically Dhaka, face ongoing obstacles due to health service disparities based on social inequality. Strategies for disease prevention require a clear comprehension of how gender interacts with vaccination procedures. ***Objective:*** To identify trends and gender patterns of EPI vaccination among children in Dhaka, Bangladesh, and examine the distribution of vaccination services across different healthcare facilities. ***Methods:*** This cross-sectional study analyzed data from 5,088 children aged 0-23 months (51% aged 0-11 months; 49% aged 12-23 months) who received EPI vaccines in Dhaka. Vaccination records for six vaccines (BCG, Pentavalent, PCV, OPV, IPV, and MR) were examined to identify monthly patterns by gender and service delivery distribution. ***Results:*** Analysis revealed varying gender patterns across different vaccines and doses. BCG vaccination showed slight male predominance (53.4% vs. 46.6%), with monthly fluctuations. Multi-dose vaccines displayed complex patterns: males generally had higher coverage for initial doses, but gender gaps narrowed for subsequent doses. Notably, MR vaccination showed female predominance in several months. Local government facilities provided the majority (65-80%) of vaccinations compared to public hospitals. ***Conclusion:*** Gender disparities in EPI vaccination exist but vary by vaccine type, dose, and month. Decentralized healthcare delivery systems require strengthened facilities because of their significant contribution to healthcare provision. Wider availability of gender-specific vaccination services and better community outreach strategies, alongside research about urban vaccination characteristics, should be implemented to battle immunization inequality in urban Bangladesh.

**Keywords:** EPI (Expanded Program on Immunization), VPD (Vaccine Preventable Diseases), Vaccination, EPI, Gender Patterns.



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## INTRODUCTION

Immunization stands as the most economical public health measure which decreases both child deaths and sickness rates (World, 2019) [1]. The World Health Organization (WHO) launched the Expanded Program on Immunization (EPI) in 1974 because it serves as a global mechanism for increasing vaccination coverage which prevents vaccine-preventable diseases (VPDs) including tuberculosis, polio, diphtheria, tetanus, pertussis, hepatitis B, Haemophilus influenzae type b (Hib), pneumococcal diseases and measles (Kundu *et al*., 2023) [2]. Bangladesh started using the Expanded Program on Immunization in 1979 and through various improvements developed high immunization coverage in recent years (Bhuiyan *et al*., 2021) [3]. The country's achievements in vaccination remain subject to urban challenges in Dhaka because the city faces swift population changes along with income inequality that reduces vaccine availability among populations (Uddin *et al*., 2018) [4]. The current EPI program of Bangladesh delivers six vaccines which consist of Bacillus Calmette-Guérin vaccine known as BCG together with Pentavalent (DTP-HepB-Hib), Pneumococcal Conjugate Vaccine named PCV, Oral Polio Vaccine called OPV, Inactivated Polio Vaccine labeled IPV, and Measles-Rubella vaccine referred to as MR (Directorate General of Health Services, 2020) [5]. Medical researchers now consider easy healthcare access involving vaccines as an essential factor that determines complete health success rates (Bhuiyan *et al*., 2021) [3]. Multiple South Asian research studies indicate that health providers administer vaccines more frequently to male than female children (Corsi *et al*., 2009) [6]. A wide range of factors including cultural preferences for male children and economic status together with social norms influence health care disparities in South Asia (Prusty & Kumar, 2014) [7]. Studies about gender disparities in vaccination coverage in Bangladesh present conflicting evidence because some research reveals small gender differences (Nasreen *et al*., 2017) [8]. The evaluation of vaccination coverage patterns together with gender-based data helps in creating specific strategies to enhance immunization services for the population. Health system strengthening and resource allocation benefits from identifying how vaccination services get distributed across various healthcare facilities (Oyo-Ita *et al*., 2023) [9]. The research investigates the patterns of EPI vaccine usage by children across both genders in Dhaka Bangladesh while studying how vaccination services are allocated between public sector and local government medical centers. The research results will support studies about urban immunization coverage in Bangladesh while providing necessary information to authorities for improving vaccination strategy development and gender equity evaluation.

## METHODS

### Study Design and Population

The research used cross-sectional methods to study EPI vaccine recipients between 0 and 23 months old who lived in Dhaka, Bangladesh. The study population comprised 5,088 children, with 2,600 (51%) in the 0-11 months age group and 2,488 (49%) in the 12-23 months age group. The study period was January 2024 to December 2024.

### Data Collection

Data on vaccination status were collected from Public health facility and Local government health facilities at DSCC ward no 6. Information on the type of vaccine received, timing of vaccination, gender of the child, and the type of health facility providing the service was systematically extracted. The study examined coverage for six EPI vaccines: BCG, Pentavalent, PCV, OPV, IPV, and MR.

### Data Analysis

The research evaluated patterns of registration for monthly vaccines across genders for each vaccine through data analysis. Research showed the annual vaccination rates and proportions between male and female infants by using percentages and frequencies. The researchers evaluated how vaccination services were split between public hospitals and local government facilities. The SPSS, Excel ant others statistical software used for date analysis and interpretation.

### Ethical Considerations

The study was conducted in accordance with ethical guidelines for health research. All data were anonymized to protect the privacy and confidentiality of the children and their families.

## RESULTS

Out of the 5,088 children included in the study, 2,600 (51%) were in the 0-11 months age group, while 2,488 (49%) were in the 12-23 months age group (Table 1).

**Table 1: Distribution of Participants by Age Group**

| Age Group | N | % |
|---|---|---|
| 0-11 Month | 2600 | 51% |
| 12-23 Month | 2488 | 49% |

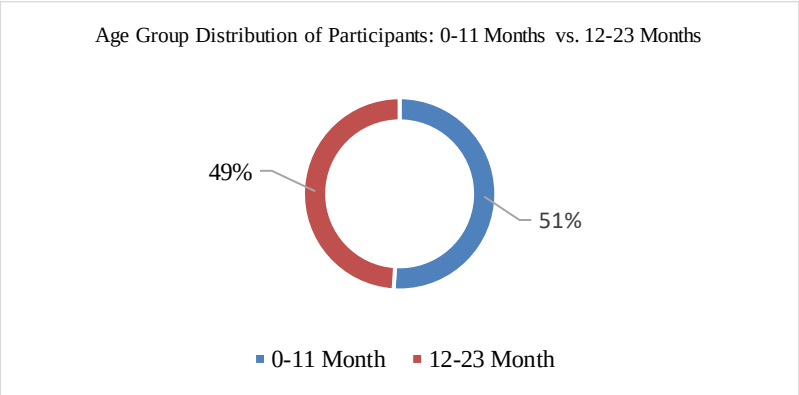


**Figure 1: Pie Chart Showed Age Group Distribution of Participants: 0-11 Months vs. 12-23 Months**

BCG vaccination data for children aged 0-11 months showed that among 598 vaccinated children, 320 (53.4%) were male and 278 (46.6%) were female. Monthly analysis revealed fluctuations in gender distribution, with the highest male-to-female ratio observed in June and August (61.7% males vs. 38.3% females). Conversely, October showed a higher percentage of females receiving BCG vaccination (54.4% females vs. 45.6% males) (Table 2).

**Table 2: BCG Vaccine: 0-11year Monthly Male and Female Frequencies and Percentages**

| Month | Male | | Female | |
|---|---|---|---|---|
| | (n) | (%) | (n) | (%) |
| **Jan** | 25 | 46.3% | 24 | 44.4% |
| **Feb** | 25 | 48.1% | 27 | 51.9% |
| **Mar** | 26 | 60.5% | 17 | 39.5% |
| **Apr** | 25 | 56.8% | 19 | 43.2% |
| **May** | 18 | 54.5% | 15 | 45.5% |
| **Jun** | 29 | 61.7% | 18 | 38.3% |
| **Jul** | 27 | 50.9% | 26 | 49.1% |
| **Aug** | 29 | 61.7% | 18 | 38.3% |
| **Sep** | 31 | 56.9% | 24 | 43.1% |
| **Oct** | 31 | 45.6% | 37 | 54.4% |
| **Nov** | 25 | 52.1% | 23 | 47.9% |
| **Dec** | 29 | 49.3% | 30 | 50.7% |
| **Total** | **320** | **53.4%** | **278** | **46.6%** |

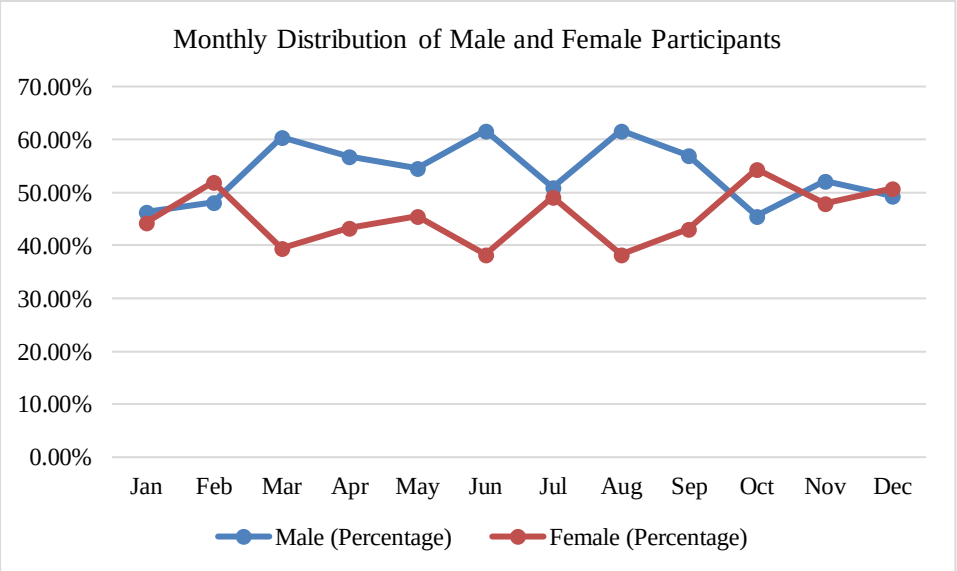

**Figure 2: Line Chart Showed Monthly Distribution of Male and Female Participants**

The Pentavalent vaccine, administered in three doses, showed varying gender patterns across different doses and months. For the first dose, the overall male percentage was generally higher than females throughout most months, with the highest male percentage in September (47.6% males vs. 27.5% females). For the second dose, gender distribution showed fluctuations, with November having the highest male percentage (57.8% males vs. 42.2% females). The third dose followed a similar pattern with male percentages generally higher than females across most months (Table 3).

**Table 3: Pentavalent Vaccine: 0-11year Monthly Male and Female Frequencies and Percentages**

| Month | 1st Male | | 1st Female | | 2nd Male | | 2nd Female | | 3rd Male | | 3rd Female | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Jan** | 30 | 35.7% | 33 | 39.3% | 25 | 29.6% | 31 | 36.9% | 36 | 42.9% | 28 | 33.3% |
| **Feb** | 44 | 44.4% | 36 | 36.4% | 35 | 35.0% | 24 | 24.2% | 17 | 17.0% | 21 | 21.2% |
| **Mar** | 33 | 34.0% | 36 | 36.0% | 48 | 48.0% | 44 | 44.0% | 28 | 28.0% | 21 | 21.0% |
| **Apr** | 29 | 28.9% | 20 | 20.0% | 28 | 28.0% | 31 | 31.0% | 44 | 44.0% | 40 | 40.0% |
| **May** | 20 | 21.3% | 11 | 11.7% | 34 | 36.2% | 30 | 31.9% | 47 | 50.0% | 41 | 43.6% |
| **Jun** | 33 | 33.0% | 19 | 19.0% | 34 | 34.0% | 17 | 17.0% | 35 | 35.0% | 25 | 25.0% |
| **Jul** | 30 | 33.3% | 27 | 30.0% | 22 | 24.4% | 30 | 33.3% | 39 | 43.3% | 30 | 33.3% |
| **Aug** | 38 | 38.8% | 30 | 30.6% | 24 | 24.5% | 33 | 33.7% | 27 | 27.8% | 31 | 31.9% |
| **Sep** | 51 | 47.6% | 30 | 27.5% | 30 | 28.0% | 32 | 29.6% | 36 | 33.6% | 32 | 30.2% |
| **Oct** | 37 | 36.7% | 43 | 42.6% | 38 | 37.6% | 35 | 34.7% | 37 | 36.7% | 35 | 34.7% |
| **Nov** | 18 | 28.1% | 21 | 32.8% | 37 | 57.8% | 27 | 42.2% | 34 | 53.1% | 33 | 50.0% |
| **Dec** | 41 | 38.9% | 35 | 33.0% | 35 | 33.3% | 28 | 26.4% | 48 | 46.2% | 40 | 38.1% |

**Table 4: PCV Vaccine: 0-11year Monthly Male and Female Frequencies and Percentages**

| Month | 1st Male (F) | | 1st Female | | 2nd Male | | 2nd Female | | 3rd Male | | 3rd Female | | 0- Male (F) | | 0 -Female (F) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Jan** | 30 | 35.7% | 33 | 39.3% | 25 | 29.4% | 21 | 24.7% | 36 | 42.9% | 28 | 33.3% | 4 | 4.8% | 2 | 2.4% |
| **Feb** | 44 | 44.4% | 36 | 36.0% | 35 | 35.0% | 28 | 28.0% | 17 | 17.0% | 21 | 21.0% | 4 | 4.0% | 2 | 2.0% |
| **Mar** | 33 | 34.0% | 36 | 36.0% | 48 | 48.0% | 44 | 44.0% | 28 | 28.0% | 21 | 21.0% | 4 | 4.0% | 1 | 1.0% |
| **Apr** | 29 | 28.9% | 20 | 20.0% | 28 | 28.0% | 31 | 31.0% | 44 | 44.0% | 40 | 40.0% | 0 | 0.0% | 3 | 3.0% |
| **May** | 20 | 21.3% | 21 | 22.0% | 34 | 36.2% | 30 | 31.9% | 47 | 50.0% | 41 | 43.6% | 1 | 1.1% | 3 | 3.2% |
| **Jun** | 33 | 33.0% | 19 | 19.0% | 34 | 34.0% | 27 | 27.0% | 35 | 35.0% | 25 | 25.0% | 3 | 3.2% | 1 | 1.1% |
| **Jul** | 30 | 33.3% | 27 | 30.0% | 22 | 24.4% | 30 | 33.3% | 39 | 43.3% | 30 | 33.3% | 2 | 2.2% | 3 | 3.3% |
| **Aug** | 38 | 38.8% | 30 | 30.6% | 24 | 24.5% | 33 | 33.7% | 27 | 27.8% | 31 | 31.9% | 1 | 1.0% | 1 | 1.0% |
| **Sep** | 51 | 47.6% | 30 | 27.5% | 30 | 28.0% | 32 | 29.6% | 36 | 33.6% | 32 | 30.2% | 0 | 0.0% | 2 | 1.9% |
| **Oct** | 37 | 36.7% | 43 | 42.6% | 38 | 37.6% | 35 | 34.7% | 25 | 25.0% | 35 | 34.7% | 2 | 2.0% | 6 | 5.9% |
| **Nov** | 18 | 28.1% | 21 | 32.8% | 37 | 57.8% | 27 | 42.2% | 34 | 53.1% | 33 | 50.0% | 3 | 4.7% | 2 | 3.1% |
| **Dec** | 41 | 38.9% | 35 | 33.0% | 35 | 33.3% | 28 | 26.4% | 48 | 46.2% | 40 | 38.1% | 4 | 4.1% | 4 | 4.1% |

PCV vaccination data revealed patterns similar to Pentavalent vaccination, with males generally having higher coverage rates across most months for all three doses. The zero dose (for those who missed regular scheduling) showed relatively low percentages for both genders, with slightly higher rates among males in most months (Table 4).

OPV vaccination data for children aged 0-11 months showed varying gender patterns across the three doses. For the first dose, males had higher coverage in most months except January, March, and October. For the second dose, the gender distribution was more balanced, with females having higher coverage in several months. The third dose showed males having higher coverage in most months (Table 5).

**Table 5: OPV Vaccine: 0-11year Monthly Male and Female Frequencies and Percentages**

| Month | 1st Male | | 1st Female | | 2nd Male | | 2nd Female | | 3rd Male | | 3rd Female | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Jan** | 30 | 47.6% | 33 | 52.4% | 25 | 46.3% | 21 | 39.6% | 36 | 56.3% | 28 | 53.8% |
| **Feb** | 44 | 55.0% | 36 | 45.0% | 35 | 59.3% | 24 | 40.7% | 17 | 44.7% | 21 | 55.3% |
| **Mar** | 33 | 47.8% | 36 | 52.2% | 48 | 52.2% | 44 | 47.8% | 28 | 57.1% | 21 | 42.9% |
| **Apr** | 29 | 40.3% | 20 | 27.0% | 28 | 47.5% | 31 | 52.5% | 44 | 52.5% | 40 | 47.5% |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **May** | 20 | 29.9% | 11 | 16.4% | 34 | 52.3% | 30 | 47.7% | 47 | 53.7% | 41 | 46.3% |
| **Jun** | 33 | 41.8% | 19 | 23.8% | 34 | 50.7% | 27 | 41.5% | 35 | 58.3% | 25 | 41.7% |
| **Jul** | 30 | 37.5% | 27 | 33.8% | 22 | 42.3% | 30 | 57.7% | 39 | 56.9% | 30 | 43.1% |
| **Aug** | 38 | 46.9% | 30 | 37.5% | 24 | 42.9% | 33 | 57.1% | 27 | 46.6% | 31 | 53.4% |
| **Sep** | 51 | 57.6% | 30 | 33.3% | 30 | 48.4% | 32 | 51.6% | 36 | 52.2% | 32 | 47.8% |
| **Oct** | 37 | 46.0% | 43 | 54.0% | 38 | 52.0% | 35 | 48.0% | 25 | 41.7% | 35 | 58.3% |
| **Nov** | 18 | 29.0% | 21 | 33.3% | 37 | 55.2% | 27 | 42.9% | 34 | 50.7% | 33 | 49.3% |
| **Dec** | 41 | 54.7% | 35 | 45.3% | 35 | 49.3% | 28 | 39.4% | 48 | 54.5% | 40 | 45.5% |

IPV vaccination data for children aged 12-23 months showed that for the first dose, gender distribution varied by month, with females having higher coverage in January, March, October, and December. For the second dose, males had higher coverage in most months, with the highest male percentage in December (60.6% males vs. 39.4% females) (Table 6).

**Table 6: IPV Vaccine: 12-23year Monthly Male and Female Frequencies and Percentages**

| Month | 1st Male | | 1st Female | | 2nd Male | | 2nd Female | |
|---|---|---|---|---|---|---|---|---|
| | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Jan** | 30 | 46.9% | 33 | 53.1% | 36 | 56.3% | 28 | 43.8% |
| **Feb** | 44 | 55.0% | 36 | 45.0% | 17 | 44.7% | 21 | 55.3% |
| **Mar** | 33 | 47.8% | 36 | 52.2% | 28 | 57.1% | 21 | 42.9% |
| **Apr** | 29 | 40.3% | 20 | 27.0% | 44 | 52.2% | 40 | 47.8% |
| **May** | 20 | 29.9% | 21 | 31.3% | 47 | 53.8% | 41 | 46.2% |
| **Jun** | 33 | 41.8% | 19 | 23.8% | 35 | 58.3% | 25 | 41.7% |
| **Jul** | 30 | 37.5% | 27 | 33.8% | 39 | 56.1% | 30 | 43.9% |
| **Aug** | 38 | 46.9% | 30 | 37.5% | 27 | 42.9% | 31 | 48.4% |
| **Sep** | 51 | 57.6% | 30 | 33.3% | 36 | 53.5% | 32 | 46.5% |
| **Oct** | 37 | 46.0% | 43 | 54.0% | 25 | 41.7% | 35 | 58.3% |
| **Nov** | 33 | 49.3% | 34 | 50.7% | 33 | 57.1% | 25 | 42.9% |
| **Dec** | 35 | 42.9% | 48 | 57.1% | 40 | 60.6% | 26 | 39.4% |

MR vaccination for children aged 12-23 months showed interesting gender patterns. For the first dose, females had higher coverage in January, April, June, and December, with the highest female percentage in June (65.9% females vs. 34.1% males). For the second dose, the gender distribution varied by month, with females having higher coverage in March, April, June, October, November, and December (Table 7).

**Table 7: MR Vaccine: 12-23year Monthly Male and Female Frequencies and Percentages**

| Month | 1st Male | | 1st Female | | 2nd Male | | 2nd Female | |
|---|---|---|---|---|---|---|---|---|
| | (n) | (%) | (n) | (%) | (n) | (%) | (n) | (%) |
| **Jan** | 19 | 39.6% | 29 | 60.4% | 12 | 63.2% | 7 | 36.8% |
| **Feb** | 18 | 52.9% | 16 | 47.1% | 19 | 57.1% | 14 | 42.9% |
| **Mar** | 19 | 59.4% | 13 | 40.6% | 14 | 43.8% | 18 | 56.3% |
| **Apr** | 23 | 47.9% | 25 | 52.1% | 13 | 40.6% | 19 | 59.4% |
| **May** | 23 | 50.0% | 23 | 50.0% | 21 | 53.8% | 18 | 46.2% |
| **Jun** | 14 | 34.1% | 27 | 65.9% | 14 | 33.3% | 28 | 66.7% |
| **Jul** | 38 | 52.9% | 35 | 47.1% | 26 | 55.3% | 21 | 44.7% |
| **Aug** | 29 | 55.8% | 23 | 44.2% | 29 | 55.5% | 23 | 44.5% |
| **Sep** | 26 | 51.0% | 25 | 49.0% | 25 | 62.5% | 15 | 37.5% |
| **Oct** | 32 | 51.6% | 31 | 48.4% | 16 | 44.4% | 20 | 55.6% |
| **Nov** | 25 | 52.1% | 23 | 47.9% | 26 | 47.3% | 29 | 52.7% |
| **Dec** | 26 | 44.8% | 32 | 55.2% | 29 | 42.0% | 40 | 58.0% |

Analysis of vaccination service distribution revealed that local government facilities provided the majority of vaccinations across all vaccine types compared to public hospitals. The proportion of vaccines administered at local government facilities

ranged from 65% for Pentavalent vaccine to 80% for PCV and IPV vaccines (Table 8).

**Table 8: Distribution of Vaccination Coverage Across Public and Local Government Hospitals**

| Vaccine | Public Hospital | | Local Govt. Hospital | |
|---|---|---|---|---|
| | (n) | (%) | (n) | (%) |
| **BCG** | 179 | 30.0% | 419 | 70.0% |
| **Pantavent** | 806 | 35.0% | 1496 | 65.0% |
| **PCV** | 458 | 20.0% | 1832 | 80.0% |
| **OCV** | 704 | 30.0% | 1644 | 70.0% |
| **ICV** | 310 | 20.0% | 1240 | 80.0% |
| **MR** | 324 | 30.0% | 756 | 70.0% |

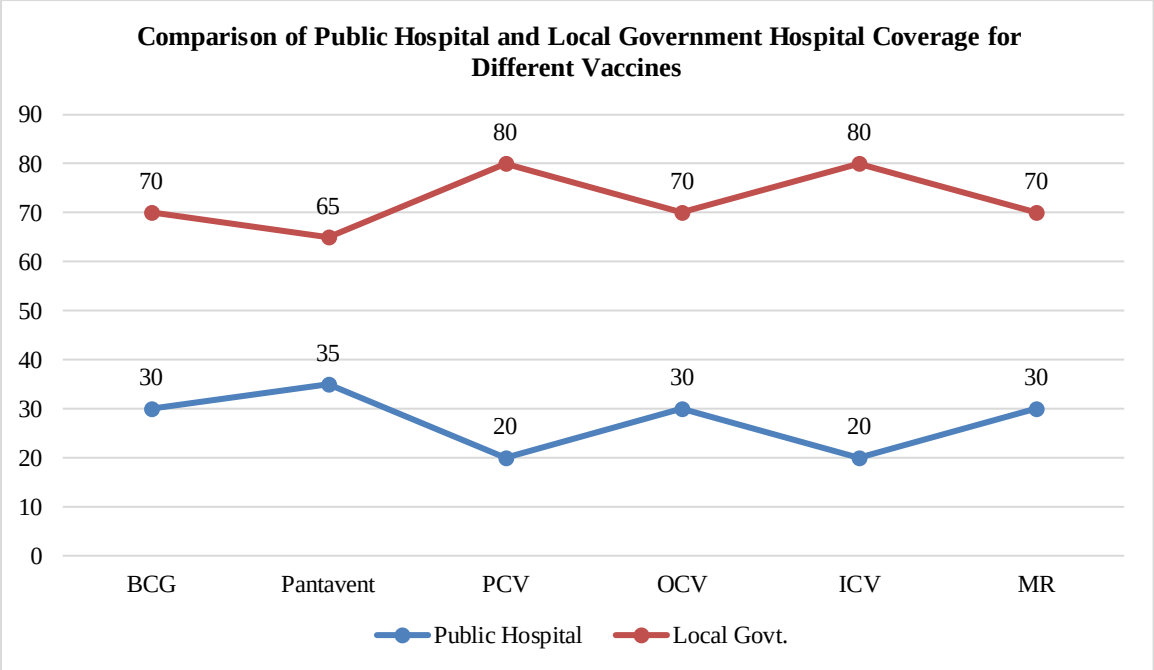


**Figure 3: Line Chart Showed Comparison of Public Hospital and Local Government Hospital Coverage for Different Vaccines**

## DISCUSSION

The research yields vital knowledge about vaccine administration behavior for children in Dhaka Bangladesh according to their gender profiles. Vaccination coverage rates differ between different vaccines as well as between specific months and gender groups which affects how immunization programs should be planned and carried out. BCG vaccination data demonstrated a male dominance at 53.4% compared to 46.6% of female children in alignment with South Asian studies by Corsi *et al*., (2009) [6]. Differential healthcare behaviors of the population stem from cultural preferences for male offspring which leads to these distribution patterns (Prusty & Kumar, 2014) [7]. Additional drivers including season-dependent migration patterns combined with health service provisions and community vaccination initiatives likely affect how vaccinations distribute between the genders throughout each month (Sarker *et al*., 2019) [10]. Different vaccine doses from the Pentavalent PCV OPV IPV and MR group show various gender demographics depending on multiple usage occasions. Initial doses of Pentavalent and PCV along with OPV vaccines showed higher coverage among male children though male and female coverage became closer or exchanged positions for subsequent vaccination doses. The research findings dispute previous studies in India and Pakistan which documented increased gender differences in vaccine receipt among later doses (Tracey *et al*., 2022) [11]. The findings from the study indicate that Bangladesh's EPI program successfully addresses gender equity in vaccination services for later doses among the population of Dhaka. The data showed females obtained superior vaccination rates specifically during the first dose period in various months. Other vaccines and doses show male preference but the MR vaccination demonstrates female prevalence. Nasreen *et al*., (2017) [8]

conducted a nationwide study in Bangladesh which produced results showing small differences between gender alignments in measles vaccination. Parents have demonstrated enhanced measles awareness for their female children because rubella infections during pregnancy endanger their risk of developing congenital complications (Jubaida *et al*., 2019) [12]. Local government facilities play a defining role in vaccination service delivery by offering support for 65-80 percent of all vaccinations as Bangladesh runs its immunization program through decentralized networks. The WHO (2021) [13] emphasizes the importance of local facilities which match the worldwide strategy to improve primary healthcare activities for delivering vital health services like immunization. Local government facilities seem to serve more people for vaccinations than public hospitals because their locations are closer to communities and they have broader opening times and active outreach programs (Uddin *et al*., 2018) [4]. Our research data shares both matching and contradictory information with other vaccination studies within Bangladesh and neighboring countries. Ahmed *et al*., (2010) [14] documented small variations between male and female vaccination coverage numbers in rural Bangladesh although their results did not match all our study findings about dose differences per gender. According to Corsi *et al*., (2009) [6] gender differences in vaccination coverage in India became more marked among families with lower economic standing thus suggesting societal background affects vaccination participation for men and women. The data in our research shows changing vaccination coverage amounts as well as gender patterns between months which needs more study. Monsoon flooding and religious celebrations and harvest season activities potentially create health care barriers that influence vaccination statistics (Chowdhury *et al*., 2013) [15].

## CONCLUSION

The study reveals significant findings about EPI vaccination practices as well as gender patterns within the child population of Dhaka region Bangladesh. The research shows multiple patterns regarding vaccination coverage across different vaccines and doses and periods where gender frequencies differ substantially. The vaccination data showed that various vaccines performed better with male recipients however other vaccines demonstrated no gender imbalance and some presented female predominance at specific times. Local government facilities play a crucial role in vaccine distribution therefore it becomes essential to improve decentralized healthcare delivery systems for enhanced immunization coverage. Monthly patterns of vaccination demand identify specific intervention requirements which need to consider seasonality and cultural and healthcare access factors that affect patient interactions with the healthcare system. To enhance vaccination coverage and gender equity, strengthen outreach, implement gender-sensitive strategies, improve local healthcare capacity, and research factors influencing monthly vaccination trends to ensure equitable immunization and reduce childhood mortality.

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