RESEARCH PAPER

Effectiveness of community health worker interventions in improving vaccination coverage.

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ABSTRACT
Background: Incomplete immunization remains a major public health challenge, particularly in underserved communities where access barriers, poor follow-up, and limited awareness contribute to suboptimal vaccination coverage. **Objective:** To assess the effectiveness of community health worker interventions in improving vaccination coverage. **Methods:** This was a quasi-experimental study conducted at Hayat Abad Medical Complex- MTI Peshawar from June 2024 to June 2025 including 210 participants/households to assess the effectiveness of community health worker interventions in improving vaccination coverage. **Results:** Full vaccination coverage increased significantly from 29.5% to 73.3% ($p<0.001$), while incomplete immunization declined from 70.5% to 26.7%. Mean missed vaccine doses decreased from 2.8 ± 1.4 to 1.1 ± 0.9 ($p<0.001$), timely vaccination improved from 33.8% to 69.5%, and dropout between vaccine doses decreased from 22.9% to 8.1%. At follow-up, the intervention group had higher full vaccination coverage than the comparison group (80.0% vs 66.7%; $p=0.031$) and lower missed doses (0.8 ± 0.7 vs 1.4 ± 1.0; $p=0.004$). Combined receipt of three or more community health worker activities achieved the highest full vaccination coverage (85.5%). **Conclusion:** Community health worker interventions significantly improved vaccination coverage and immunization-related outcomes..
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INTRODUCTION

Immunization is one of the most cost-effective ways to prevent morbidity and mortality from vaccine-preventable diseases in children, especially in low- and middle-income countries [1]. While significant improvements have been made in immunization programs, there remain persistent gaps in immunization coverage attributed to vaccine-related access, knowledge, health system and vaccine hesitancy barriers [3]. These underlie preventable outbreaks and inequities in children's health [5]. Community health workers (CHWs) are increasingly recognised as an essential bridge between health systems and communities, especially in disadvantaged areas [2]. Holding roles in outreach, education, mobilization, follow-up and referral, CHWs can enhance access to basic health care, such as vaccination [4]. Their embeddedness in the community allows them to play a role in overcoming social, geographic and behavioural barriers to vaccination [6]. A number of interventions delivered by CHWs, such as reminder visits, defaulter tracing, counselling caregivers, and mobilising communities, have been shown to enhance routine immunization coverage [7]. These interventions may be crucial in settings where missed immunization is due to lack of awareness, poor tracking, or lack of access to formal health services [9].

Recent studies have shown that CHW interventions can improve completion of vaccine doses, timely delivery of vaccination and the dropout rate between doses [8]. Research has also found that community outreach and involvement of parents may increase uptake and confidence

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in immunization [10]. These studies support the increasing use of CHWs in immunization. In many developing countries, gaps in immunization continue to be linked with low maternal education, poverty, lack of access to health facilities and poor understanding of immunization schedules [11]. Community-based initiatives can help to overcome these challenges by providing services closer to the community and better continuity of care [13]. CHWs can also help to identify missed children and improve equity. Countries such as Pakistan have not achieved optimal coverage for routine immunization, despite national immunization programs [12]. Gaps and missed opportunities in vaccination coverage are significant public health issues, especially in disadvantaged populations [14]. Hence, community-level interventions could be key to improving coverage. While CHW interventions have been promising, the effectiveness may depend on the type, intensity and context of implementation [15] [16].

Objective

To assess the effectiveness of community health worker interventions in improving vaccination coverage.

Methodology

This was a quasi-experimental study conducted at Hayat Abad Medical Complex- MTI Peshawar from June 2024 to June 2025 including 210 participants/households to assess the effectiveness of community health worker interventions in improving vaccination coverage.

Inclusion Criteria

Households with children eligible for routine immunization according to national vaccination schedule
Caregivers willing to participate in the study
Children with incomplete or ongoing vaccination schedules at enrollment
Participants providing informed consent

Exclusion Criteria

Households planning relocation during the study period
Children with completed age-appropriate vaccination schedules at baseline
Caregivers unwilling to participate in follow-up
Households with incomplete baseline or outcome data
Children with contraindications to routine vaccination

Data Collection

After institutional approval, data were collected using a structured proforma. Baseline variables included child age, caregiver education, socioeconomic status, baseline immunization status, missed vaccine doses, and access to health facilities. The intervention included community health worker activities such as household visits, caregiver counseling, reminder follow-up, defaulter tracing, and community mobilization regarding vaccination schedules. Vaccination coverage was assessed before and after intervention using documented receipt of age-appropriate vaccines, completion rates, and timeliness of immunization. The primary outcome was improvement in vaccination coverage following community health worker intervention.

Statistical Analysis

Data were entered and analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. Comparisons between intervention and comparison groups and pre- versus post-intervention outcomes were assessed using chi-square test and paired t-test where appropriate. Stratification was performed for caregiver education, socioeconomic status, and baseline immunization status to control for effect modifiers. A p-value ≤0.05 was considered statistically significant.

Results

Baseline characteristics were comparable between groups. Mean child age was 18.6 ± 7.4 months, with similar age distribution in intervention (18.4 ± 7.2) and comparison groups (18.8 ± 7.6; p=0.741). Baseline incomplete immunization was high in both groups (69.5% vs 71.4%), while low socioeconomic status (61.9% vs 63.8%) and lower caregiver education (58.1% vs 60.0%) were similarly distributed, indicating balanced groups at enrollment.

Table 1: Baseline Demographic and Household Characteristics (n=210)

Variable	Total (n=210)	Intervention (n=105)	Comparison (n=105)
Child Age (months), Mean ± SD	18.6 ± 7.4	18.4 ± 7.2	18.8 ± 7.6
Male Children	116 (55.2%)	59 (56.2%)	57 (54.3%)
Caregiver with Primary or Less Education	124 (59.0%)	61 (58.1%)	63 (60.0%)
Low Socioeconomic Status	132 (62.9%)	65 (61.9%)	67 (63.8%)
Baseline Incomplete Immunization	148 (70.5%)	73 (69.5%)	75 (71.4%)
Distance >5 km to Facility	91 (43.3%)	44 (41.9%)	47 (44.8%)

Fully vaccinated children increased from 29.5% to 73.3% (p<0.001), while incomplete immunization declined from 70.5% to 26.7%. Mean missed vaccine doses decreased from 2.8 ± 1.4 to 1.1 ± 0.9 (p<0.001), timely vaccination improved from 33.8% to 69.5%, and dropout between doses decreased from 22.9% to 8.1%, showing significant improvement in immunization outcomes.

Table 2: Vaccination Coverage Outcomes Before and After Intervention

Outcome	Pre-Intervention	Post-Intervention	P-value
Fully Vaccinated Children	62 (29.5%)	154 (73.3%)	<0.001
Incomplete Immunization	148 (70.5%)	56 (26.7%)	<0.001

Mean Missed Vaccine Doses	2.8 ± 1.4	1.1 ± 0.9	<0.001
Timely Vaccination Coverage	71 (33.8%)	146 (69.5%)	<0.001
Dropout Between Vaccine Doses	48 (22.9%)	17 (8.1%)	0.002

Full vaccination coverage was higher in the intervention group (80.0% vs 66.7%; p=0.031), while mean missed doses were lower (0.8 ± 0.7 vs 1.4 ± 1.0; p=0.004). Defaulter recovery was also significantly greater in the intervention arm (37.1% vs 21.0%; p=0.010), supporting a beneficial effect of community health worker support.

Table 3: Comparison of Outcomes by Study Group

Variable	Intervention (n=105)	Comparison (n=105)	P-value
Fully Vaccinated at Follow-Up	84 (80.0%)	70 (66.7%)	0.031
Mean Missed Doses	0.8 ± 0.7	1.4 ± 1.0	0.004
Timely Vaccination Coverage	78 (74.3%)	68 (64.8%)	0.141
Dropout Between Doses	6 (5.7%)	11 (10.5%)	0.203
Defaulter Recovery	39 (37.1%)	22 (21.0%)	0.010

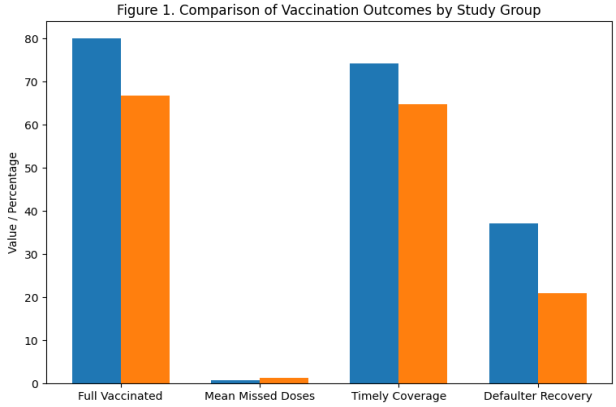

Figure 1. Comparative Vaccination Outcomes in Intervention and Comparison Groups Following Community Health Worker Support

Intervention exposure was more frequent among fully vaccinated children (54.5% vs 37.5%; p=0.031). Higher caregiver education (48.1% vs 21.4%; p=0.001), better socioeconomic status (40.9% vs 26.8%; p=0.048), and shorter distance to health facility (62.3% vs 41.1%; p=0.008).

Table 4: Factors Associated with Full Vaccination Coverage at Follow-Up

Variable	Fully Vaccinated (n=154)	Not Fully Vaccinated (n=56)	P-value
Intervention Exposure	84 (54.5%)	21 (37.5%)	0.031
Caregiver Secondary+ Education	74 (48.1%)	12 (21.4%)	0.001
Higher Socioeconomic Status	63 (40.9%)	15 (26.8%)	0.048
Distance ≤5 km to Facility	96 (62.3%)	23 (41.1%)	0.008
Baseline Incomplete Immunization	101 (65.6%)	47 (83.9%)	0.012

Full vaccination was achieved in 82.6% receiving household counseling, 81.8% receiving reminder follow-up, and 80.3% among those reached through defaulter tracing. The highest success was observed among households receiving combined ≥3 CHW activities, where 85.5% achieved full vaccination (p<0.001).

Table 5: Community Health Worker Intervention Components and Impact

CHW Component	Received n (%)	Full Vaccination Achieved n (%)	P-value
Household Counseling	92 (43.8%)	76 (82.6%)	<0.001
Reminder Follow-Up	88 (41.9%)	72 (81.8%)	<0.001
Defaulter Tracing	61 (29.0%)	49 (80.3%)	0.002
Community Mobilization Sessions	74 (35.2%)	58 (78.4%)	0.006
Combined ≥3 CHW Activities	69 (32.9%)	59 (85.5%)	<0.001

Discussion

This quasi-experimental intervention study assessed the impact of community health worker (CHW) interventions on vaccination coverage and found substantial improvements in immunization following intervention. The results suggest that outreach interventions can help plug vaccination gaps, enhance follow-up, and improve coverage [17]. Key findings of this study include the considerable increase in full vaccination coverage from 29.5% at baseline to 73.3% following intervention (p<0.001) and the reduction in incomplete immunization coverage from 70.5% to 26.7%. And the average number of missed vaccine doses fell significantly from 2.8 ± 1.4 to 1.1 ± 0.9. This suggests a strong impact of CHW involvement on immunization coverage. Other studies have also shown that intervention by CHWs to conduct outreach can enhance immunization rates for children, and reduce missed opportunities for vaccination [18]. The intervention group also had better performance than the comparison group at follow-up, with higher full vaccination coverage (80.0% vs 66.7%; p=0.031), lower mean missed doses (0.8 ± 0.7 vs 1.4 ± 1.0; p=0.004), and significantly higher defaulter recovery (37.1% vs 21.0%; p=0.010). These results indicate that active CHW engagement is not only associated with improved vaccination coverage, but also defaulter recovery. Other studies have similarly demonstrated the value of

home visits, reminders and defaulter tracing in improving immunization service continuity [19]. We also observed a substantial improvement in timeliness of vaccination, from 33.8% to 69.5%, and in dropout between doses, from 22.9% to 8.1%. These results are significant given that improved timeliness and lower dropout reflect improved adherence to the immunization schedule, rather than simply higher coverage. Other studies have also shown that CHW interventions can lead to better completion and timeliness of vaccination [20].

A number of other factors were associated with improved vaccination, including caregiver education, socioeconomic status and proximity to health facilities. Our results indicate that while CHW interventions have a positive impact, more social and access factors still affect vaccination coverage. Other studies have also found that maternal education, socioeconomic status and access to health care play a role in vaccination coverage [21]. A key finding of this study was that multiple interventions seemed to be more effective. Households exposed to three CHW interventions had the highest full vaccination coverage (85.5%) compared to households exposed to single interventions. This may indicate the possibility of additive effects. Other studies have also proposed integrated approaches (counseling, reminders and follow-up) may be superior to individual interventions [22]. The high success rates for household counseling (82.6%), reminder follow-up (81.8%) and defaulter tracing (80.3%) also support the importance of community-based, one-on-one communication strategies. These approaches may increase caregiver knowledge, dispel myths, and prevent non-attendance. Other studies have reported that face-to-face communication and follow-up are key mechanisms of improved immunization. The results of this study have public health implications, especially in the context of incomplete immunization. The high rate of incomplete immunization (70.5%) at baseline and the significant increase following the intervention suggests that community health workers may be a feasible approach to improving routine immunization services. Other studies have also supported the inclusion of CHWs in primary health care to enhance preventive care services. This study shows that community health worker strategies were effective in improving vaccination coverage, missed doses, timeliness, and recovering defaulters. These results are in line with other studies and endorse the use of community-based approaches to improve immunization programs.

Conclusion

It is concluded that community health worker interventions significantly improved vaccination coverage, reduced incomplete immunization, decreased missed vaccine doses, improved timeliness of vaccination, and supported recovery of defaulters. Households receiving structured community health worker support, particularly multi-component interventions involving counseling, reminder follow-up, and defaulter tracing, demonstrated better immunization outcomes. Higher caregiver education, improved access to health facilities, and favorable socioeconomic conditions were also associated with better coverage...

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