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Integrating Polio SIAs with other Health Interventions in Sindh, Pakistan:

Challenges and Prospects

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Abstract

Polio eradication remains a critical global health goal, with Pakistan being one of the few countries where wild poliovirus transmission persists (WHO, 2021). Despite decades of interventions under the Global Polio Eradication Initiative (GPEI, 2024), progress is impeded by vaccine hesitancy, misinformation, and weak health infrastructure. Karachi, Sindh's urban hub, faces persistent immunization gaps, particularly in high-risk union councils (UCs) (CDC, 2023). This study evaluates the feasibility and impact of integrating polio Supplementary Immunization Activities (SIAs) with other essential services—including maternal care, sanitation, nutrition, and routine immunization—in eight high-risk UCs of Karachi. Using a mixed-methods approach, including household surveys, focus group discussions, and key informant interviews, the research explores barriers and enablers to successful integration (GPEI, 2024b). It examines whether this model can reduce vaccine refusals, build community trust, and improve health access in resource-constrained settings (UNICEF, 2023). Findings inform scalable strategies that not only enhance polio coverage but also strengthen the broader healthcare system (GPEI, 2024a). The study contributes evidence toward the global eradication agenda by promoting equity-based, community-driven integration models applicable to other polio-endemic regions.

Keywords: *Acute flaccid paralysis, Expanded Programme on Immunization,*

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Global Polio Eradication Initiative, Lot quality assurance sampling, Oral polio vaccine, Routine (Essential) immunization, Social and behavior change communication, World Health Organization.

1. Introduction

Polio eradication remains a critical global health priority, with Pakistan being one of the few countries where wild poliovirus continues to circulate. Despite progress through the Global Polio Eradication Initiative (GPEI), challenges such as vaccine hesitancy, misinformation, and logistical barriers hinder efforts, particularly in Sindh, where immunization coverage remains below global targets (GPEI, Polio Eradication Initiative Update, 2024). Out of 64 cases during 2024 in the country, Sindh's tally to 17 alone, at the time of this writing. It underscores the need for specific and tailored approach in high-risk areas.

Routine immunization (RI) coverage in Sindh, including DTP3/Penta-3, remains at 60%, which is below the national average of 75% and significantly below the global target of 90% (WHO, World Health Organization (WHO), 2023. Global Vaccine Action Plan Progress Report 2023, 2023). Moreover, up to 15% of children are consistently missed during polio campaigns, particularly in densely populated urban areas of Karachi (NEOC, 2024). This increases the risk of virus transmission and perpetuates the spread of polio. Global health organizations, including WHO and GPEI, emphasize the integration of SIAs with other essential health services as a strategy for addressing these challenges, citing evidence of success in countries such as Nigeria, India, and Bangladesh.

This study examined the integration of SIAs with maternal care, nutrition, and sanitation services in high-risk urban areas of Karachi, with the goal of assessing the feasibility and impact of this approach. By providing a more comprehensive healthcare package, the study aims to reduce vaccine refusals, increase community trust, and improve public health outcomes. The findings will support the development of strategies for scaling up integrated health services across Pakistan, contributing to the global effort to eradicate polio.

Pakistan remains one of the last countries with endemic WPV1, and Karachi continues to exhibit sustained environmental detections and recurrent transmission despite frequent SIAs (WHO, 2025; GPEI, 2025). Evidence from high-risk urban settlements links persistent vaccine refusals to socio-cultural barriers and mistrust of narrowly focused "polio-only" outreach (Soofi et al., 2023). Early programmatic evaluations in Karachi suggest that co-delivering essential services (e.g., maternal–child health, RI, and nutrition) alongside polio rounds can improve acceptance and uptake, indicating a plausible pathway to reduce refusals and close immunity gaps (Abbasi et al., 2025). By rigorously testing an integrated SIA model in Sindh's highest-risk areas, this study addresses a critical evidence gap for the GPEI endgame and provides

immediately actionable guidance for EPI strengthening, urban health equity, and interruption of poliovirus transmission in Pakistan (WHO, 2025; GPEI, 2025).

1.1. Problem Statement

Globally, wild poliovirus (WPV) has been reduced by >99% since 1988, and WPV2 (2015) and WPV3 (2019) are certified eradicated; however, WPV1 transmission persists in only Pakistan and Afghanistan (Global Polio Eradication Initiative [GPEI], 2025). In 2024 the world recorded 99 WPV1 cases—74 in Pakistan—and 741 WPV1-positive environmental samples (628 in Pakistan) (World Health Organization [WHO], 2025a, 2025b; WHO Regional Office for the Eastern Mediterranean, 2025). By 30 July 2025, Pakistan's cumulative WPV1 cases for 2025 reached 17, reflecting continued transmission through the low-season and into the high-season (GPEI, 2025b). Environmental surveillance in 2025 also remained highly positive, with 245 WPV1-positive sewage detections in Pakistan as of 4 June 2025 (WHO, 2025b).

Within Pakistan, resurgence since 2023 has been concentrated in historical reservoirs—including Karachi and the Quetta block—with Sindh (Karachi) contributing substantially to detections despite frequent Supplementary Immunization Activities (SIAs). Surveillance analyses show sharp increases in WPV1-positive sewage in 2023–2024 across Karachi, Peshawar, and Quetta, indicating sizable under-immunized cohorts and silent transmission (Mbaeyi et al., 2024; WHO, 2025a, 2025b). Concurrently, vaccine refusals have risen in underserved urban communities, driven by socio-cultural barriers, misinformation, and mistrust of programs perceived as "polio-only," especially where broader health needs remain unmet (Soofi et al., 2023).

Emerging programmatic evidence suggests that integrating polio SIAs with essential services (e.g., maternal/child health, routine immunization, nutrition, and basic primary care) can improve acceptance and coverage. In Karachi (2021), health-camp models co-delivered services alongside/after polio rounds: child immunization among attendees increased from 80% → 86% → 96% across rounds, and ~80% of prior OPV refusers accepted vaccination at camps, indicating trust gains when broader needs are addressed (Abbasi et al., 2025).

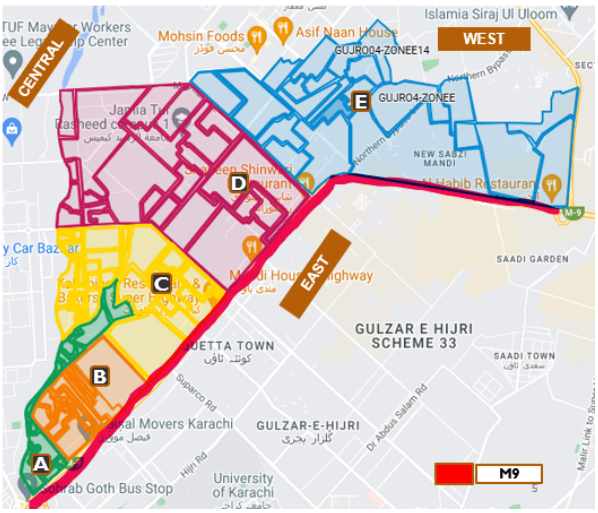
Therefore, this study assessed whether integrating polio SIAs with additional essential health interventions can reduce refusals, improve immunization coverage, and strengthen public-health outcomes in high-risk urban areas of Sindh—particularly Karachi—where sustained virus circulation and high environmental-positivity persist despite repeated campaigns. The hypothesis is that integrated delivery will build trust, lower refusal rates, and close immunity gaps more effectively than polio-only SIAs (Abbasi et al., 2025; Mbaeyi et al., 2024; WHO, 2025a, 2025b).

1.2. Gujro: Introduction & Dynamics

Figure 1

Gujro Population & Social Map

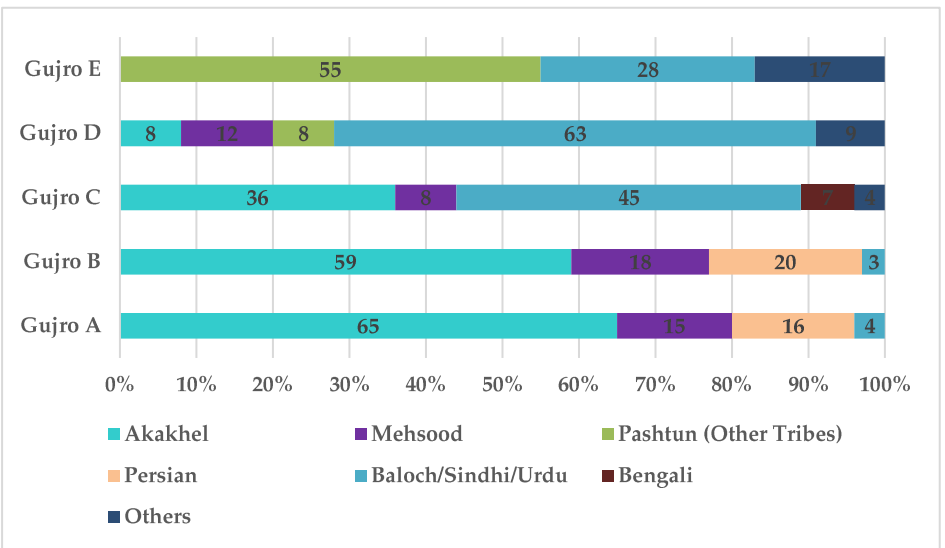
Number of Zones	**5**
Total Population	**634553**
Target < 5 years	**107874**
Target EPI Population (<2 Year)	**39215**
Number of HFs (govt+ pvt)	**36 (4+32)**
Number of EPI Centers	**13**
Number of LHW	**20**
Number of Vaccinators	**54**
Active sites/zero reporting	**22/28**
Last VDPV2 case	**Oct-20**
Last WPV1 case	**Sep-24**
Last Positive ENV Sample	**Nov-24**
Last Compatible Case	**15 Oct-2020**



Gujro (Sohrab Goth) consists of 5 union councils/zones known as Zones A, B, C, D and E. It inhabits mostly communities from tribal areas of South KPK.

Figure 2

Zone wise ethnicity Profile of Gujro



This study investigated whether integrating polio SIAs with other essential health services can measurably improve program performance in Karachi's high-risk urban areas. It asks: (i) how effective such integration is in reducing vaccine refusals; (ii) what operational and socio-cultural challenges arise in urban centers like Karachi; (iii) whether coupling SIAs with maternal care, family planning, sanitation, and nutrition improves broader public-health outcomes; and (iv) which operational models can scale this approach in high-risk regions of Pakistan. Correspondingly, the study's main objective is to evaluate an integrated SIA model that increases vaccination uptake by at least 20% and enhances public-health outcomes. Specific objectives are to assess the contribution of integrated maternal care, family planning, sanitation, and nutrition services toward achieving the ≥20% uptake target; measure a ≥15% reduction in vaccine refusals; identify key operational and socio-cultural barriers to implementation; and generate evidence-based recommendations for scalable integration to accelerate poliovirus eradication.

1.3. Scope of the Study:

This study shall focus on high-risk urban areas in Sindh, with a particular emphasis on Karachi, where vaccine refusals are largely prevalent. The research evaluates integration of SIAs with essential healthcare services, including maternal care, sanitation, and nutrition. Also, it investigates community-level barriers (such as socio-cultural resistance) and operational challenges (such as logistical difficulties) involved in implementing these integrated services. The findings shall help to develop scalable model that could be adapted and applied to other high-risk regions across Pakistan — contributing to the overall goal of polio eradication and improved public health outcomes.

1.4. Literature Review

Global Polio Eradication Initiative (GPEI) launched in 1988, has been instrumental in reducing global polio cases by over 99%. The initiative's multi-pronged approach includes enhanced surveillance, outbreak response, and SIAs—door-to-door vaccination campaigns targeting children under five in areas with low RI coverage. Despite its success globally, Pakistan and Afghanistan remain the last two countries where wild poliovirus transmission persists, accounting for endemic cases of the disease (WHO, World Health Organization (WHO), 2022. Polio Global Eradication Report, 2023).

1.4.1. Global Insights on Polio Eradication & Integrated Health Interventions

Studies from countries that have eradicated polio highlight the effectiveness of integrating SIAs with broader health interventions. In **Nigeria**, the combination of polio SIAs with maternal health services, malaria prevention (e.g., distribution of insecticide-treated bed nets), and Vitamin A supplementation

played a critical role in improving vaccine acceptance. These integrated efforts not only enhanced immunization coverage but also built community trust in health services, culminating in Nigeria's certification as polio-free in 2020 (WHO, 2020). Moreover, operational innovations such as community-based workforce training and enhanced data collection systems were key to success (GAVI, 2020).

Similarly, India's Mission Indradhanush linked polio SIAs with a broader immunization drive that included vaccines for diphtheria, measles, and tetanus, alongside maternal and child health services. A meticulous focus on high-risk areas—urban slums and underserved rural regions—resulted in significant improvements in immunization coverage, which rose from 65% in 2014 to over 85% in 2017. These efforts contributed directly to India being certified polio-free in 2014 (UNICEF, 2022). Additionally, intensive community engagement campaigns, such as door-to-door visits by female health workers and engagement of religious leaders, addressed vaccine hesitancy in culturally sensitive regions (Patel, 2018).

1.4.2. Challenges and Opportunities in Pakistan

In Pakistan, efforts to integrate SIAs with broader health services have yielded promising, albeit limited, results. Initial studies demonstrate that pairing polio vaccinations with maternal and child health services in high-risk areas of Karachi has reduced vaccine refusals by up to 72% (Khan, 2021). These integrated efforts, supported by community health workers, have shown that addressing maternal health needs simultaneously builds trust in immunization programs. Furthermore, initiatives like Expanded Program on Immunization (EPI) have demonstrated the utility of leveraging existing RI systems to reach underserved populations (R, 2019).

The use of mobile health (mHealth) platforms has further facilitated real-time tracking of vaccination coverage and cold-chain management in Pakistan. For instance, a study conducted in province of Sindh highlighted the role of SMS-based reminders in improving caregiver compliance with vaccination schedules by 30% (V, 2021). Similarly, digital dashboards enabled better planning of SIAs in urban areas by identifying clusters of unvaccinated children (S, 2022)

1.5. Hypothesis

H_1: The integration of Polio SIAs with maternal care and sanitation services significantly reduces vaccine refusals in high-risk communities.

H_2: Operational and cultural challenges influence the success of integrating SIAs with other healthcare services.

2. Methodology

2.1. Study Design

This study is grounded in a pragmatic paradigm with a critical-realist stance. Pragmatism prioritizes answering "what works, for whom, and under what conditions," which is appropriate for evaluating a complex public-health intervention (integration of SIAs with essential services) in dynamic urban settings. The critical-realist lens assumes real causal mechanisms (e.g., trust, access, service quality) that operate within specific contexts (high-risk UCs in Karachi) and can be uncovered through complementary methods.

Accordingly, we employed a mixed-methods, quasi-experimental design with repeated cross-sectional household surveys at three time points—pre-integration (T0), early post-integration (T1, ~1–2 months), and follow-up (T2, ~6 months)—and an embedded qualitative component (in-depth interviews and focus group discussions). This design allows estimation of change over time in vaccine uptake/refusals and exploration of the mechanisms (trust, perceived benefits, service experience) that may explain those changes. Where feasible, comparison neighborhoods with routine polio-only SIAs were observed to enable difference-in-differences contrasts; where not feasible, we rely on pre–post inference with robust covariate adjustment and sensitivity analyses.

Primary outcomes. (i) OPV uptake among eligible children during/after SIA rounds; (ii) vaccine refusals (active or passive, per national classification). Secondary outcomes. Attendance at integrated service points; selected service use (e.g., antenatal visit in last month, child nutrition counseling received), and acceptability of integrated delivery.

2.2. Study Setting and Population

The study was conducted in five high-risk Union Councils (UCs) in District East, Karachi, identified by high environmental surveillance positivity and historically elevated refusal burdens. Target populations included households with eligible children, as well as frontline providers (vaccinators, CMs/CHWs, supervisors) and community influencers/leaders engaged in SIAs.

2.3. Sampling Strategy and Sample Size

Quantitative (households): We used multi-stage cluster sampling: in each UC, clusters (neighborhood blocks/lanes) were selected proportional to population size; within clusters, households were chosen via systematic random sampling. The achieved sample was n = 265 households across five UCs (allocated proportional to UC size).

The study aimed to detect an absolute increase of 20 percentage points in OPV uptake (e.g., 60%→80%), two-sided α=0.05, power=80%. For two independent

proportions, the minimum per-round n ≈ 82; applying a design effect of 1.5 for clustering yields ~123 per round. Allowing 10% non-response increases this to ~136. Our total of 265 households across waves meets/exceeds the precision target, with distribution across UCs to preserve representativeness and permit UC-level fixed effects in analysis.

Qualitative (IDIs/FGDs): We used purposive sampling to capture variation by role and context until thematic saturation. Planned minimums:

IDIs (n≈24–30): vaccinators, CHWs/CMs, UC supervisors/EPI staff, and community leaders (religious/elders).

FGDs (n≈6–8 groups; 6–8 participants each): mothers/caregivers (segmented by prior refusal/acceptance) and fathers/guardians.
Recruitment continued until no new codes/themes emerged.

2.4. Instrument Development and Sources of Variables

Household survey: The instrument was developed from validated modules and adapted to the Karachi context through expert review and piloting. Construct domains and sources included:

- Vaccination demand & confidence (items aligned with widely used vaccine demand/confidence constructs, e.g., confidence, constraints, complacency, collective responsibility).
- Behavioral and Social Drivers (BeSD-aligned) domains: perceived risk/benefit, social norms, practical issues (distance, wait time), decision-making autonomy.
- Service preferences for integrated offerings (e.g., WASH/soap, maternal care, family planning, nutrition counseling, child sick-visit/consultation).
- Exposure to information/misinformation (channels, frequency, trust in sources).
- Socio-demographics (caregiver age/sex, education, household size, SES proxies).
  Question wording was adapted from established immunization and household survey modules (e.g., national/DHS-style immunization modules and common refusal-reason lists used operationally), with local phrasing refined via cognitive interviews.

Interview/FGD guides. Semi-structured guides were built on implementation frameworks (e.g., acceptability, feasibility, appropriateness) and integration mechanisms (perceived added value, convenience, equity). Guides probed: experiences delivering/receiving integrated services, drivers of refusal/acceptance, trust and program image, logistical enablers/barriers, gender and privacy considerations, and suggestions for scale-up.

2.4.1. Development process.

Item generation from literature and operational tools; 2) expert panel review (EPI/PEI practitioners, social scientists) for content validity; 3) cognitive testing with 12 caregivers; 4) pilot in a non-study UC (n≈30) to assess flow, skip patterns, and timing; 5) revisions. Reliability: multi-item scales targeted Cronbach's $\alpha \geq 0.70$; construct validity was examined via exploratory factor analysis (EFA) and refined through confirmatory factor analysis (CFA) at T0/T1.

2.5. Data Collection Procedures and Quality Assurance

Enumerators and qualitative facilitators received standardized training (survey protocol, consent, neutrality, confidentiality). Tools were administered in local languages with back-translation to ensure semantic equivalence. Field supervisors performed daily spot-checks, re-visits (5%), and logic checks in the data system. Qualitative sessions were audio-recorded, professionally transcribed in the source language, and translated to English with cross-checks.

2.6. Variables and Operational Definitions

- OPV uptake (primary): receipt of OPV dose during/after the index SIA round for eligible child(ren), verified by card/finger-mark or caregiver report.
- Refusal (primary): documented refusal during SIA (active/passive) or caregiver self-report of refusal at last contact.
- Integrated service exposure (secondary): attendance at an integrated point and/or receipt of any added service (e.g., ANC counseling, FP information/commodities per policy, nutrition counseling, WASH kit/soap).
- Covariates: caregiver confidence score, prior SIA experience, SES proxy (asset index), parity, child age/sex, distance/time to service point, information exposure, UC fixed effects.

3. Data Analysis

3.1. Quantitative

- Weighting/Design: survey weights reflect selection probabilities; cluster-robust standard errors account for sampling design.
- Descriptive statistics: means/proportions with 95% CIs; visualization of uptake/refusal trends (T0–T2).
- Bivariate tests: χ^2 tests for proportions; t-tests or non-parametric equivalents for continuous scores.

- Primary effect estimation:
    - Pre–post models: logistic regression for uptake/refusal with time indicators (T1, T2 vs. T0), adjusted for covariates and UC fixed effects.
    - Difference-in-differences (if comparison areas available): interaction of time × intervention, with GEE (exchangeable correlation) or mixed-effects logistic models (random intercept for cluster).
- Mechanism analysis: associations between service-preference/receipt and OPV uptake (adjusted ORs).
- Sensitivity analyses: (i) alternative refusal definitions; (ii) excluding missing verification; (iii) models with/without weights; (iv) multiple imputation for covariates if missingness >5%.
- Effect size target: report absolute risk differences and adjusted ORs with 95% CIs; present marginal effects for interpretability.

3.2. Qualitative (Thematic Analysis)

We conducted reflexive thematic analysis (Braun & Clarke approach): familiarization, initial coding, theme development, review, definition, and reporting. Coding used NVivo/Atlas.ti with a hybrid codebook: deductive codes from the guides/frameworks plus inductive codes emerging from data.

- Core nodes (parent codes): Trust & program image; Information/misinformation; Access & logistics; Gender & privacy; Experience of integration (perceived added value, wait time, courtesy, quality); Community norms & influencers; Equity & inclusion; Incentives (e.g., soap kit) & motivation; Provider workload & support; Operational coordination.
- Illustrative sub-themes: "Polio-only fatigue," "One-stop convenience," "Respectful treatment," "Household decision authority," "Religious/elder endorsements," "CHW credibility," "Queue management," "Commodity stockouts," "Data feedback loops."
- Rigor: dual-coding of 20% transcripts; discrepancies resolved through adjudication; codebook memos maintained; data triangulation across IDIs/FGDs and surveys; audit trail preserved. Inter-coder agreement (Cohen's κ) was monitored with a priori threshold ≥ 0.75.

3.3. Integration of Quantitative & Qualitative Methods

Findings were integrated at analysis and interpretation stages via joint displays linking quantitative effects (e.g., uptake increase) with qualitative explanations

(e.g., reduced "polio-only" mistrust, improved convenience). Convergences, complementarities, and discrepancies were explicitly noted to address the research gap on *how and why* integration affects refusals in resource-constrained urban settings.

3.4. Bias, Limitations, and Mitigation

Potential biases include selection bias (migration/mobility), recall/social-desirability bias, and confounding by concurrent campaigns. Mitigations: probability sampling, verification of doses where possible, neutral question framing, model adjustment for confounders, UC fixed effects, and sensitivity analyses. Qualitative reflexivity and triangulation addressed researcher influence and context effects.

3.5. Ethics and Data Protection

Ethical approval was obtained from the appropriate Institutional Review Board. Written or witnessed verbal informed consent was obtained from all participants; parental permission was obtained for caregiver participation. Data were de-identified, stored on encrypted drives, and accessed only by the study team. No incentives were tied to vaccination decisions; any material support (e.g., soap) complied with program policy.

3.6. Research Gaps

Despite growing evidence for integrating SIAs with other healthcare services, significant gaps still remain. There is a lack of rigorous studies evaluating the long-term sustainability of these interventions in resource-constrained environments like Pakistan. Additionally, understanding the operational challenges of scaling integrated health services to rural areas is limited, including logistical issues and community engagement strategies. Research is needed on the role of mobile health platforms in improving vaccine coverage and on how cultural beliefs impact the acceptance of integrated services. Evaluations of cost-effectiveness and the effectiveness of community health workers (CHWs) in these initiatives are also essential. Finally, comparative studies of regions with differing success rates in integration could assist in identifying best practices.

4. Findings of the Study:

The study employed multiple units of analysis to capture a comprehensive understanding of the integrated health service intervention. The primary unit for quantitative analysis was households with under-five children (n = 265), selected from high-risk areas to assess changes in vaccine uptake and service preferences. For qualitative insights, 24 in-depth interviews were conducted with frontline workers, including vaccinators, community mobilizers (CMs), community health workers (CHWs), and Union Council (UC) medical staff, to explore operational challenges and successes in implementing integrated

services. Additionally, six focus group discussions (FGDs) were held with community members, segmented by gender, age, and previous vaccination behavior, to examine perceptions, trust dynamics, and cultural factors influencing acceptance. Lastly, the Union Councils (UCs) of Gujro A–E served as contextual units, allowing comparative analysis across different geographic and programmatic conditions.

The pie chart (figure-4) below demonstrates how integrating polio SIAs with essential services can significantly impact vaccine acceptance rates among hesitant households. The largest proportion of respondents, 58%, indicated that sanitation and hygiene support, particularly the provision of soap, played a pivotal role in their willingness to vaccinate their children with the Oral Polio Vaccine (OPV). This finding underscores the value of linking vaccination campaigns with tangible and immediate benefits that address basic needs. The act of providing soap not only incentivizes participation but also aligns with broader public health objectives, such as promoting hygiene practices to prevent communicable diseases. This approach effectively combines disease prevention with addressing the community's immediate concerns, making it a cost-effective strategy to drive higher vaccination rates.

Beyond sanitation and hygiene, 15% of respondents prioritized maternal health services, emphasizing the interconnectedness of child and maternal well-being. Offering services like antenatal care, postnatal counseling, or nutritional support during vaccination drives could enhance trust and demonstrate the broader value of healthcare interventions. Similarly, 12% of households highlighted the importance of health education, which suggests that a significant barrier to vaccine acceptance lies in misinformation or lack of awareness. Educational initiatives can address misconceptions, empowering communities to make informed decisions and fostering long-term trust in immunization programs.

Smaller yet notable proportions of respondents emphasized other needs, such as water filtration plants, basic utilities like gas and electricity (6%), and school-related services (9%). These preferences reflect the socio-economic struggles of many households in high-risk areas, where addressing broader infrastructural challenges alongside immunization can create goodwill and improve participation. Overall, the findings highlight that while simple, practical incentives like soap can drive immediate results, a multifaceted approach tailored to community-specific needs is essential for sustainable improvements in vaccine acceptance and public health outcomes. This evidence suggests that integrating SIAs with essential health and socio-economic services has the potential to address vaccine hesitancy while improving the overall well-being of vulnerable communities.

Figure 3

Number of households agreeing to OPV vaccination in return of other services

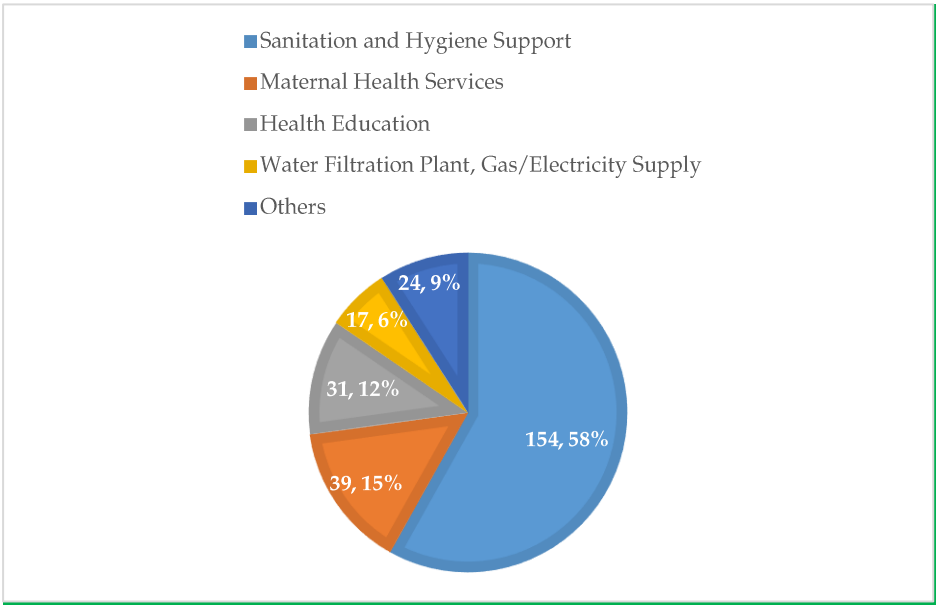


Table 1

Baseline Characteristics of the Respondents

Characteristics of Respondents	All (n=154)	Yes (n=148)	No (n=0)	Not Sure (n=6)
Age		Yes	No	Not Sure
> 45	16	15 (10%)	0 (0)	1 (0.65)
1< 18	4	4 (3)	0 (0)	0 (0)
18-30	57	55 (36)	0 (0)	2 (1.30)
31-45	77	74 (48)	0 (0)	3 (1.95)
Gender				
Female	58	53 (34)	0 (0)	5 (3.2)
Male	96	95 (62)	0 (0)	1 (0.6)
Education				
Higher Education	23	23 (15)	0 (0)	0 (0)
No Formal Education	95	91 (59)	0 (0)	4 (2.6)

Characteristics of Respondents	All (n=154)	Yes (n=148)	No (n=0)	Not Sure (n=6)
Primary	8	7 (5)	0 (0)	1 (0.6)
Secondary	28	27 (18)	0 (0)	1 (0.6)
Occupation				
Daily Wage Worker	61	60 (39)	0 (0)	1 (0.6)
Healthcare Professional	6	6 (4)	0 (0)	0 (0)
Housewife	49	44 (29)	0 (0)	5 (3.2)
Office Worker	4	4 (3)	0 (0)	0 (0)
Other	16	16 (10)	0 (0)	0 (0)
Unemployed	18	18 (12)	0 (0)	0 (0)
Household Size				
1 to 3	21	20 (13)	0 (0)	1 (0.6)
4 to 6	47	46 (30)	0 (0)	1 (0.6)
7 to 10	59	54 (35)	0 (0)	4 (2.6)
> 10	28	28 (18)	0 (0)	0 (0)
Ethnicity				
Baloch	6	6 (4)	0 (0)	0 (0)
Pashtun	60	54 (35)	0 (0)	6 (3.8)
Punjabi	19	19 (12)	0 (0)	0 (0)
Sindhi	41	41 (27)	0 (0)	0 (0)
Other	28	28 (18)	0 (0)	0 (0)

Out of 154 respondents, the majority (148 individuals) supported the integration of hygiene and sanitation services with Polio SIAs. A very small group (6 respondents) were unsure about the integration, and no participants outright rejected the idea.

The majority of those agreeing to the integration belonged to the 31-45 age group (48%), followed by 18-30 (36%). This indicates that individuals in their working and family-raising years are more inclined to accept the integration of hygiene services, due to their direct involvement in childcare and their recognition of sanitation as a critical issue. Among the "Not Sure" respondents, a small number were spread across the 31-45 and 18-30 groups, showing that

hesitancy might stem from lack of awareness rather than outright opposition. A higher number of males (62%) compared to females (34%) supported the integration. However, females also showed a notable level of acceptance, reflecting their active role in household and childcare decisions. Among the "Not Sure" group, females (3.2%) had higher representation, which indicates a need for targeted education and engagement for this group to clarify the benefits of integration. Interestingly, respondents with no formal education (59%) formed the largest group agreeing to the integration, which underscores the importance of practical, immediate benefits like hygiene support for populations with limited educational access. Individuals with higher education (15%) unanimously supported integration, reflecting their understanding of the potential public health benefits. "Not Sure" responses came primarily from those with no or minimal education, emphasizing the need for outreach and education campaigns to address any confusion or lack of information.

On the other hand, daily wage workers (39%) and housewives (29%) formed the majority of respondents supporting integration, highlighting the practical and immediate value hygiene services bring to underserved communities. Healthcare professionals also unanimously agreed, suggesting that those within the health sector recognize the strategic importance of hygiene in preventing disease. "Not Sure" responses came from housewives (3.2%) and daily wage workers (0.6%), indicating potential concerns related to household priorities or misinformation.

Moreover, Households with 7 to 10 members (35%) showed the highest level of agreement, suggesting that larger households may perceive more value in integrated services due to their higher sanitation needs. Smaller households also supported integration but to a slightly lesser extent. Hesitancy was minimal across all household sizes, showing a generally favorable outlook on this strategy. Among ethnic groups, Pashtuns (35%) and Sindhis (27%) had the highest levels of agreement, reflecting the need for targeted engagement in these communities to sustain and enhance the support. "Not Sure" responses were predominantly from Pashtuns (3.8%), which may be tied to cultural or regional differences in perceptions about public health initiatives.

The overwhelming support for integrating polio SIAs with hygiene and sanitation services highlights the practicality and acceptance of such a strategy in diverse demographic and socioeconomic groups. However, the small proportion of respondents who were unsure points to the importance of tailored communication and community engagement efforts, particularly targeting females, individuals with lower education levels, and certain ethnic groups like Pashtuns. Addressing the concerns of the hesitant groups through targeted health education and outreach can further enhance acceptance and lead to greater success in reducing vaccine hesitancy while promoting hygiene.

Table 2

Reduction in Refusals (n)

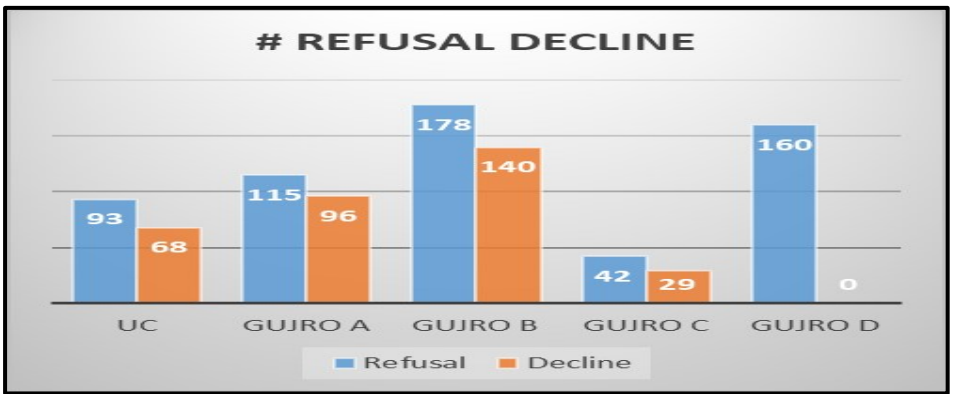


Figure 4

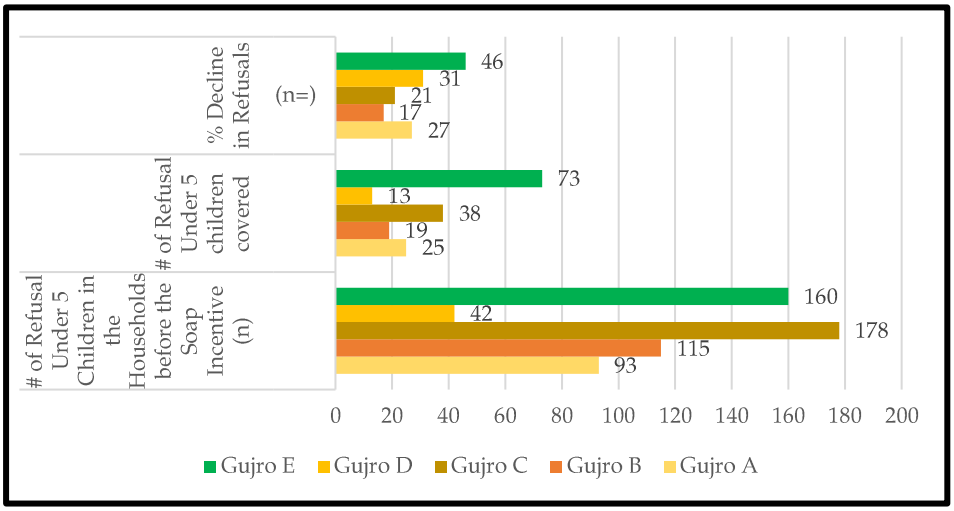
Zone wise Refusal Decline

UC	# of Households with Refusals Studied (n)	# of Refusal Under 5 Children in the Households before the Soap Incentive (n)	# of Refusal Under 5 in the House after Soap Incentive (n)	% Decline in Refusals (n=)
Gujro A	50	93	68 (73)	25 (27)
Gujro B	40	115	96 (83)	19 (17)
Gujro C	66	178	140 (79)	38 (21)
Gujro D	22	42	29 (69)	13 (31)
Gujro E	87	160	87 (54)	73 (46)

The table above illustrates the impact of a soap incentive program on the refusal rate among households with children under five years old across five hogh risk union councils (UCs), labeled as Gujro A to E. The data includes the total number of households studied, the number of refusals before and after the soap incentive, and the corresponding percentage decline in refusals. For example, Gujro A studied 50 households, with 93 refusals initially, which reduced to 68 (a 25% decline) after the soap incentive. The percentage decline varies across UCs, with Gujro E showing the highest decline (73%), whereas Gujro D experienced the lowest decline (13%). The numbers in parentheses represent the percentage of children within the households. This analysis highlights the varying effectiveness of the soap incentive program in reducing refusals among different UCs.

Figure 5

Comparison of decline in refusals (Pre and Post Soap incentive)



4.1. Findings From The Control Group

Table 3

% Decline in Refusals Without Provision of Soap

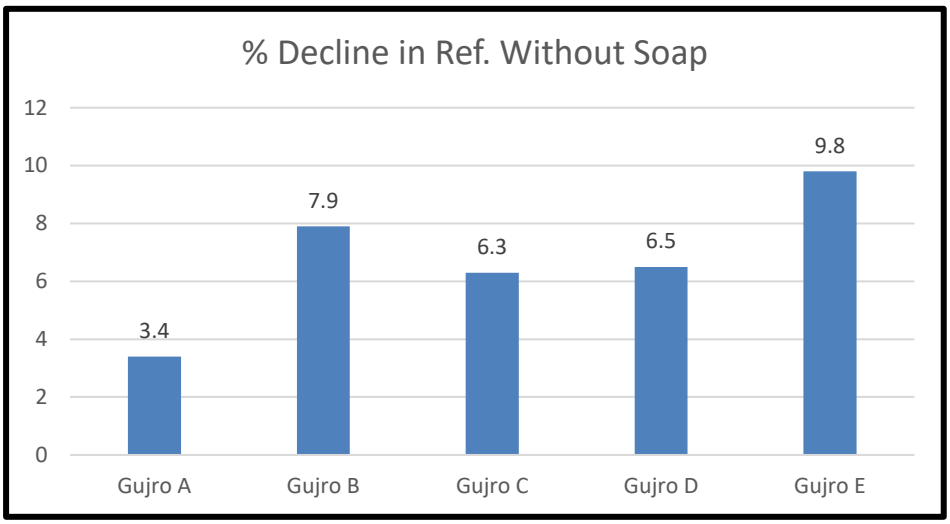
UC	# of Households with Refusals Studied (n)	# of Refusal Under 5 Children in the Households (n)	# of Refusals Vaccinated without Provision of Soap (n) % Decline
Gujro A	41	87	3 (3.4)
Gujro B	23	63	5 (7.9)
Gujro C	53	94	6 (6.3)
Gujro D	31	61	4 (6.5)
Gujro E	47	112	73 (9.8)

The table above demonstrates the variation in vaccine refusal rates among households across different UCs and the percentage decline in refusals without the provision of soap as an intervention. The UCs included in the analysis are Gujro A, Gujro B, Gujro C, Gujro D, and Gujro E, each showing distinct outcomes. Gujro E exhibited the highest decline in refusals (9.8%), indicating a relatively successful effort to address vaccine hesitancy, while Guiro A had the lowest decline (3.4%), reflecting greater resistance or less effective engagement. Gujro B, Gujro C, and Gujro D showed moderate declines of 7.9%, 6.3%, and 6.5%, respectively. These variations highlight the influence of localized factors,

such as community dynamics, cultural beliefs, and the effectiveness of healthcare communication. The findings underscore the importance of area-specific strategies to address vaccine hesitancy effectively, as uniform interventions may not achieve consistent results across all UCs. By tailoring approaches to the unique challenges of each UC, public health programs can enhance immunization efforts and improve overall healthcare delivery.

Figure 6

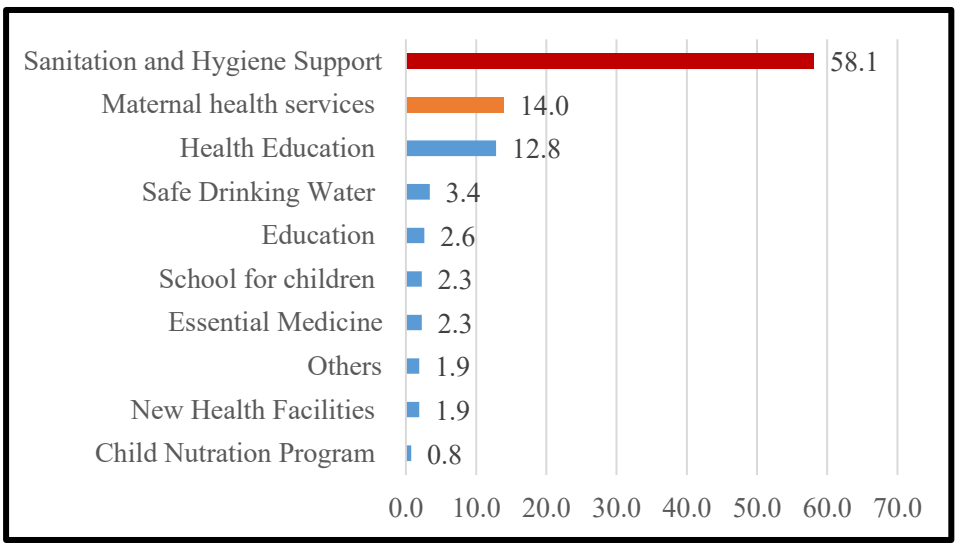
Decline % in Refusals without



4.1.1. Services Demanded by Community Which can Further Improve Immunization Rates

Figure 7

Services Demanded by Community



The chart highlights the percentage of people in communities who expressed desire for various services that could potentially improve immunization rates. The majority of respondents (58.1%) indicated that sanitation and hygiene support would significantly enhance immunization acceptance, suggesting that improved environmental conditions are a top priority for these communities. This is followed by a notable interest in maternal health services (14.0%) and health education (12.8%), indicating that addressing maternal and child health needs alongside raising awareness about vaccinations could be effective strategies for reducing hesitancy. Services such as safe drinking water (3.4%) and general education (2.6%) were less frequently mentioned but still represent important needs that could indirectly impact healthcare acceptance. Other services, including schools for children, essential medicines, and new health facilities, each accounted for around 2% of the responses, highlighting gaps in basic infrastructure and healthcare access. The least prioritized need was a child nutrition program (0.8%), which might reflect a lack of immediate recognition of its role in overall health. These findings suggest that integrating immunization campaigns with sanitation improvements and maternal health services, while simultaneously offering health education, could create trust and meet community needs, thereby increasing vaccine uptake and improving overall healthcare delivery.

4.2. Qualitative Findings (Thematic Analysis):

The thematic analysis of qualitative data—derived from 24 in-depth interviews with frontline workers and six focus group discussions (FGDs) with community members—revealed ten interlinked themes that shed light on the social, cultural, and operational dynamics influencing vaccine acceptance in high-risk urban areas of Karachi. A dominant theme that emerged was trust and program image, where participants frequently expressed fatigue with "polio-only" campaigns. Communities voiced skepticism about the long-standing focus on polio in the absence of other essential services, leading to a perception of selective and externally driven health agendas. However, when broader services were introduced—particularly maternal health consultations, hygiene kits, and nutrition support—this perception shifted, reinforcing the theme of perceived value of integration. Respondents described integrated services as a "one-stop solution" that addressed household needs more holistically, with mothers expressing particular satisfaction when both they and their children received care in a single visit.

Another salient theme was access and logistics, where many participants, especially women, cited physical distance to fixed sites and long queues as barriers. Linked to this were concerns about gender and privacy, with women often reluctant to engage with male vaccinators or discuss maternal health issues unless accompanied by trusted female health workers. The importance of community norms and influencers also surfaced prominently—decisions around child health and vaccination were often contingent on the approval of male heads of household or local religious leaders. In areas where respected figures endorsed the integrated initiative, acceptance rates visibly increased.

Participants also highlighted the persistent issue of misinformation and rumors, such as the belief that polio vaccines cause infertility or are part of a foreign agenda. These misconceptions were exacerbated by the absence of community dialogue and were often fueled by social media and informal networks. However, the introduction of incentives and motivation mechanisms, such as soap distribution and hygiene materials, played a vital role in reversing refusals. Community members repeatedly emphasized that these incentives were perceived not as bribes, but as gestures of respect and acknowledgment of their needs.

On the provider side, the theme of operational constraints emerged strongly. Frontline workers reported increased workload and limited logistical support, particularly in sustaining service continuity post-campaign. They also noted a lack of alignment between supply availability and community expectations, especially when demand for broader services outpaced resources. The theme of health system linkage further underscored this disconnect—communities welcomed referrals to government health facilities, but expressed frustration when these referrals did not result in timely or quality care, thereby

undermining the trust built during SIAs. Lastly, the theme of feedback and ownership emphasized that communities felt heard for the first time during integrated campaigns and called for more permanent, community-informed mechanisms to guide future health service delivery.

In summary, the qualitative findings suggest that while integration of polio SIAs with other health services significantly improved program acceptance and community engagement, its effectiveness hinged on trust-building, gender sensitivity, accessible delivery models, and meaningful community involvement. These insights provide critical context to the quantitative findings and reinforce the value of locally tailored, people-centered approaches to public health interventions.

The integration of quantitative and qualitative data provided a comprehensive understanding of how the addition of essential health services to polio SIAs influenced community behaviors, vaccine acceptance, and public health outcomes. Quantitative findings indicated a notable increase in OPV uptake (20–30%) across the intervention areas, with Gujro E showing the highest reduction in refusals (up to 73%) following the integration of soap distribution and basic hygiene education. These results aligned strongly with qualitative insights, where community members repeatedly emphasized that the provision of sanitation items and maternal health services enhanced the perceived value and legitimacy of the campaign. In FGDs, caregivers described how receiving hygiene kits created a sense of being respected and cared for, contrasting sharply with previous "polio-only" visits which were often dismissed as intrusive or politically motivated.

Quantitative data further highlighted that sanitation and hygiene support (58%) and maternal health services (15%) were the most preferred service add-ons influencing vaccine decisions. These statistics were substantiated through thematic analysis, where participants explained that access to these additional services filled critical gaps in their daily lives and created opportunities for interaction with health workers beyond the brief doorstep exchange. For instance, several female participants shared that receiving both antenatal advice and OPV for their children in one visit made the effort worthwhile and reduced hesitancy.

Integration of both data streams also illuminated the role of trust and social dynamics in influencing vaccine acceptance. Quantitatively, households headed by individuals aged 31–45 and those with no formal education (59%) were most receptive to integrated campaigns, while qualitative narratives explained this as a result of familiarity with CHWs, repeated engagements with trusted local influencers (e.g., religious leaders), and the visibility of tangible benefits like soap and referrals. Furthermore, male-dominated approval (62%) was found to correspond with cultural norms where men often serve as primary decision-makers; this was echoed in qualitative interviews where male

heads of households spoke of allowing vaccinations after observing community-wide participation.

Operational challenges reported in qualitative interviews—such as the mismatch between service demand and supply, lack of sustained follow-up, and workforce fatigue—also contextualized quantitative results where certain UCs showed only modest improvements. These mixed outcomes underscore the importance of logistical preparedness and community-driven design in scaling integration efforts.

In essence, the integrated findings reveal that quantitative improvements in vaccine coverage and reductions in refusals were driven by deeper qualitative factors such as improved community trust, enhanced service relevance, and participatory delivery mechanisms. The convergence of both data types validates the hypothesis that integrated health services are more acceptable, sustainable, and effective in high-risk urban settings than polio-only interventions. This mixed-methods synergy not only strengthens the credibility of the results but also offers nuanced guidance for policy and operational decisions in polio-endemic contexts like Karachi.

4.3. Discussion

This study aimed to assess whether integrating Polio Supplementary Immunization Activities (SIAs) with essential services such as sanitation, maternal care, and nutrition can enhance vaccine uptake and reduce refusals in high-risk urban areas of Karachi. The results show a clear relationship between the integration of services and improved immunization outcomes, substantiating the study's hypothesis and offering important insights aligned with each of the research questions.

4.3.1. Effectiveness of Integration in Reducing Vaccine Refusals

Aligned with the first research question, the findings demonstrate that integrating health services with polio SIAs significantly improved vaccine acceptance among target households. A majority of respondents (58%) reported that the addition of sanitation and hygiene support—particularly soap distribution—was the most influential factor in accepting oral polio vaccines. This is consistent with broader public health literature, which suggests that community engagement improves when immediate, tangible needs are addressed alongside vaccination (Gavi, 2023). The dramatic drop in refusals—up to 73% in Gujro E—confirms that offering visible benefits fosters goodwill, encourages participation, and reframes polio campaigns as a gateway to more comprehensive health services rather than isolated disease control interventions.

4.3.2. Challenges in Implementing Integrated Services

In relation to the second research question, the study found that while

integration was positively received, several implementation challenges emerged. Interviews with frontline workers revealed logistical issues such as limited supply of hygiene items, high staff burden, and short campaign durations that constrained outreach. Sociocultural factors also played a role; for example, some female participants in FGDs were hesitant to engage with male vaccinators, reflecting gender norms that need to be addressed through the deployment of female CHWs. Additionally, the presence of misinformation and cultural mistrust—particularly among Pashtun communities—created barriers to acceptance. These findings highlight the operational and community engagement limitations that must be addressed in scaling up integrated health service delivery in urban environments like Karachi.

4.3.3. Impact on Broader Public Health Outcomes

The third research question explored whether integration can improve general public health outcomes. While the primary focus of the study was vaccine uptake, findings indicate potential benefits beyond polio control. Maternal health services were cited by 15% of households as a reason for vaccine acceptance, suggesting strong community demand for antenatal care, family planning, and nutritional support. Health education, prioritized by 12% of respondents, helped dispel myths and empowered households to make informed decisions. Although less frequently mentioned, services like safe drinking water (3.4%) and child nutrition (0.8%) indicate latent needs that can be addressed through integrated health campaigns. These preferences reflect the daily health struggles of marginalized communities and indicate that polio SIAs can serve as an effective entry point for broader health promotion and disease prevention activities.

4.3.4. Scalable Operational Models

The fourth research question asked what operational models could effectively scale the integration of SIAs with health services. The findings suggest that context-specific, incentive-driven models are most effective. For instance, Gujro E's high success rate can be attributed to the integration of soap distribution with well-planned community engagement and strong female workforce participation. In contrast, Gujro D, which lacked consistent outreach and incentive mechanisms, showed the lowest decline in refusals (13%). This comparison confirms that no one-size-fits-all model exists and that scalable frameworks must be tailored to the local context, leveraging existing community structures, trust networks, and cultural sensitivities. The use of CHWs, inclusion of influential community members, and consistent service availability were highlighted as key enablers in interviews and FGDs.

4.3.5. Demographic and Socioeconomic Influences

Demographic variables were also critical in interpreting the success of integration. Individuals aged 31–45, who often play central caregiving roles, were the most supportive of integrated services. The study also found that men

(62%) were more supportive of integration than women (34%), though women showed more nuanced responses in FGDs, revealing unmet needs and the desire for more female-centered services. Education was another significant factor: 59% of respondents with no formal education supported integration primarily due to the immediate utility of incentives like soap, while higher-educated individuals (15%) unanimously endorsed integration from a health-systems perspective. These insights emphasize the need for differentiated outreach strategies based on educational and gender profiles.

4.3.6. UC-Level Comparison

Finally, UC-level comparison revealed variability in outcomes, reinforcing the need for local adaptation. Soap-linked interventions were most successful in UCs with better mobilization and interpersonal communication strategies. These findings support the idea that integrated SIAs are not only feasible but highly effective when they are community-driven, locally managed, and adapted to meet the real-time needs of the population.

4.4. Impact of Soap Incentive on Vaccine Hesitancy

The study highlights the significant impact of providing soap as an incentive to reduce vaccine hesitancy. Among the surveyed UCs, the soap incentive led to varied reductions in refusal rates, with Gujro E achieving the highest decline at 73% and Gujro D exhibiting the lowest at 13%. This disparity underscores the effectiveness of linking vaccination campaigns to immediate, tangible benefits such as hygiene products. The provision of soap addresses practical needs while simultaneously promoting broader public health goals like improved hygiene and disease prevention. The impact is particularly pronounced in communities where basic necessities are scarce, making incentives a compelling strategy to encourage participation in immunization campaigns. This approach effectively bridges the gap between community needs and public health objectives, creating a win-win scenario that fosters trust and participation in healthcare initiatives.

4.4.1. Integration of SIAs with Essential Services

Integrating polio SIAs with essential services emerged as a highly effective approach to addressing vaccine hesitancy. Sanitation and hygiene support were identified as the most critical services, with 58% of respondents highlighting their importance. Beyond hygiene, 15% prioritized maternal health services, and 12% emphasized the need for health education. These findings demonstrate that addressing broader healthcare and socio-economic needs alongside vaccination campaigns can build trust and increase vaccine uptake. Services such as antenatal care, nutritional counseling, and education campaigns complement immunization efforts by demonstrating the tangible value of healthcare interventions. This integration has the potential to not only improve vaccination rates but also strengthen the overall healthcare delivery

system, fostering long-term community trust in public health programs.

4.4.2. Sociodemographic Factors Influencing Acceptance

Sociodemographic factors, including age, gender, education, occupation, and household size, played a significant role in shaping attitudes toward integrating SIAs with essential services. Larger households (7–10 members) showed the highest levels of agreement (35%), likely due to their higher sanitation needs and greater vulnerability to infectious diseases. Occupational analysis revealed that daily wage workers (39%) and housewives (29%) formed the majority of respondents supporting integration, highlighting the immediate, practical benefits hygiene services bring to underserved communities. Healthcare professionals unanimously supported the integration, reflecting their recognition of its strategic importance in disease prevention. These findings suggest that addressing the specific needs of different socio-economic groups can enhance the effectiveness of integrated health campaigns.

4.4.3. Age and Gender

The study revealed that individuals aged 31–45 were the most supportive of integrating hygiene services with vaccination campaigns, accounting for 48% of the agreement. This age group, often engaged in childcare and household responsibilities, is directly impacted by the benefits of improved sanitation and healthcare access. Younger adults aged 18–30 also showed significant support (36%), reflecting the growing awareness of public health issues among younger populations. In terms of gender, 62% of males and 34% of females supported integration, with females also playing a notable role in household and childcare decisions. However, the "Not Sure" group was predominantly female (3.2%), indicating the need for targeted education and engagement to address their concerns and ensure informed decision-making.

4.4.4. Education

Educational background was a significant determinant of attitudes toward integrating SIAs with essential services. Respondents with no formal education (59%) formed the largest group supporting integration, suggesting that practical incentives like soap resonate most with less-educated populations. Conversely, individuals with higher education levels (15%) unanimously supported integration, likely due to their greater understanding of the public health benefits. The "Not Sure" responses primarily came from individuals with minimal education, emphasizing the need for outreach and information campaigns to address gaps in understanding and foster greater participation in immunization efforts.

4.4.5. Ethnic and Cultural Considerations

Ethnic and cultural factors also influenced vaccine acceptance. Pashtuns (35%) and Sindhis (27%) exhibited the highest levels of support for integrating SIAs

with hygiene services, reflecting the potential for targeted engagement in these communities to sustain and enhance acceptance. However, the "Not Sure" responses were predominantly from Pashtuns (3.8%), suggesting cultural or regional differences in perceptions of public health initiatives. Tailored communication strategies that address cultural norms and regional dynamics are essential to building trust and ensuring the success of integrated health campaigns in diverse communities.

4.4.6. Strategic Implications

The findings of this study have several strategic implications for public health programs. Integrating SIAs with essential services, such as hygiene support, maternal healthcare, and health education, offers a cost-effective and impactful approach to reducing vaccine hesitancy. By addressing the immediate needs of underserved communities, such interventions build trust and foster long-term acceptance of healthcare initiatives. Demographic and socio-economic analyses underscore the importance of tailoring strategies to the unique needs of different groups, including larger households, daily wage workers, women, and less-educated populations. Ethnic and cultural considerations further highlight the need for localized, culturally sensitive approaches to public health outreach.

Overall, the integration of SIAs with essential services has the potential to not only enhance immunization rates but also improve the overall well-being of vulnerable populations. By leveraging these insights, policymakers and public health practitioners can design targeted, community-centered interventions that address the root causes of vaccine hesitancy and promote sustainable health outcomes.

5. Conclusion

The study proves that the integration of polio SIAs with maternal care and sanitation services significantly reduces vaccine refusals in high-risk communities —— Hence, H1 proved. In the next place, integrated healthcare and polio-plus services (BISP and other basic civic services) improve overall public health outcomes by increasing access to multiple health interventions simultaneously but further study is needed to prove causal relationship. Lastly, operational and cultural challenges influence the success of integrating SIAs with other healthcare services—H2 proved.

The integration of polio SIAs with broader health services offers a promising pathway to improve immunization coverage and healthcare delivery. Global experiences from Nigeria and India underscore the potential of this approach, while local studies from Pakistan substantiate its feasibility in specific high-risk areas. However, addressing barriers such as cultural resistance, misinformation, and logistical constraints requires a multi-faceted strategy that prioritizes community engagement, operational innovation, and robust

research on scalability. Future studies should focus on expanding integrated health services and inclusion of polio-plus activities (BISP and availability of basic civic services) to achieve the goal of eradicating polio and achieving broader health accessibility and equity.

6. Recommendations:

6.1. Possible Impact of the Research Study

This research could significantly influence public health policies by providing evidence for the SIAs with other healthcare services in Pakistan. By demonstrating the effectiveness of this approach, the study may guide policymakers in optimizing resource allocation and developing comprehensive strategies to enhance vaccine uptake, particularly in high-risk areas. Additionally, it could empower healthcare providers to improve service delivery and community engagement, ultimately enhancing trust in vaccination programs and addressing cultural barriers to immunization.

The findings may also identify critical research gaps and inspire future studies on the sustainability of integrated health services and the role of mobile health platforms in improving vaccination coverage, contributing to a more effective public health framework for polio eradication in Pakistan.

Based on the findings of the study, the following recommendations are proposed to enhance the effectiveness of integrating polio SIAs with hygiene and other essential services:

6.1.1. A. Expand hygiene and sanitation incentives

- Distribution of soap or hygiene kits: Include soap or hygiene kits as a component of polio SIAs in very selected high-risk areas only in exceptional circumstances—given its proven effectiveness in reducing refusal rates and increasing hygiene awareness. Lest this incentive might create dependency and increase demand refusals. Soap or hygiene kits only to be offered to convert PMC refusals as a last resort.
- Broaden hygiene offerings: By expanding range of incentives like water purification plants, tablets, hand pumps and educational materials on hygiene practices. This broader approach shall also cater for other pressing community health needs.

6.1.2. B. Integrate additional public health services

- Maternal health support: Combine SIAs with services like antenatal care, postnatal counseling, and nutritional support to address broader health concerns and encourage participation.
- Health and education initiatives: Conduct localized awareness sessions focusing on the importance of vaccination and hygiene, targeting

households with low educational attainment. Provide additional hygiene kits or other resources to larger households with greater sanitation needs conditional to their behavioral change towards polio vaccine.

- Devise robust school/madrassah vaccination system: Collaborate with schools to promote vaccinations and ensure that no child is missed. Usually, schools/madrassahs refuse to vaccinate children on the flimsy pretext that prior consent of the parent is needed. This practice ought to be shunned. Registration of schools/ madrassahs should be cancelled in case of non-compliance and certificates should be displayed in the compliant schools/ madrassahs.

6.1.3. C. Targeted Communication Strategies

- Gender-sensitive messaging and youth engagement: Develop social media content specifically designed and addressing women as primary caregivers, emphasizing how hygiene and vaccination protect their children's health. The content should be made in local languages for addressing much broader audience. There is need of more vigorous media campaigns on TikTok, Instagram and Facebook to offset the misconceptions about polio SIAs. Involve individuals aged 18-30 and 31-45 as advocates for vaccination and hygiene initiatives, leveraging their active roles in their communities.
- Counter dis-information: Build a strong pro-polio vaccine narrative to dispel myths about polio vaccines. There is a pressing need to include a chapter in national curriculum about polio virus underscoring the national resolve to eradicate this menace. At the local level, trusted community and religious leaders need to be engaged to spread accurate information. Unfortunately, despite 30 years long battle against polio, there has been no concerted unanimous voice for polio campaign advocacy from religious political parties.

6.1.4. D. Community engagement and trust-building

- Engage local leaders: Involve influential community figures, including religious and tribal leaders, to promote vaccination and hygiene practices.
- Empower community health workers (CHWs): Impart training to CHWs to address vaccine hesitancy through culturally relevant engagement and clear explanations of the benefits of integrated services. There is a need to inject fresh blood on contractual basis with sufficient incentives to retain them over the long haul, on merit.

6.1.5. E. Address Socioeconomic needs and barriers

- Demand based refusals: Unfortunately, there is an increasing trend of basic civic services being demanded by communities in lieu of polio vaccine

administration to their children. Support in polio SIAs has become a bargaining chip for local level leaders and community representatives to ensure basic amenities in their respective areas of influence —with the passage of time. With increased involvement and ownership of the program by senior level government officers— number of demand based refusals keep has seen an upward trend and has risen exponentially in recent past. Failure of the state to provide these services has translated into the deliberate reluctance on the part of communities who do not see their legitimate basic civic needs met, otherwise. Two policy options exist for the government in this backdrop—either to provide basic services, such as water supply, sanitation and health services in slum areas—super high risk union councils (SHRUCs)— across the board or to coerce people to administer polio vaccine, forcibly. The former is not possible in short run and the latter may entail hidden refusals or misreporting. It calls for a very effective and robust SBCC strategy coupled with use of strong arm of the government on need basis for PMCs and enbloc refusal communities.

6.1.6. F. Improvise programs and adopt polio plus strategy

The government should gradually adopt carrot and stick approach and must make its essential services conditional with vaccine acceptance. for instance, Benazir Income Support Program (BISP) has a registry of around 9 million— BISP can be grafted on PEI-EPI program under PEI-EPI synergy to improve vaccine service delivery. It shall be a step forward from the present HH vaccination strategy to *Health facility model*— saving billions of rupees.

Figure 8

BISP Details, Source: BISP Official website

- Track refusals and collect community feedback: Regularly gather input from households to understand the usefulness of provided services and identify unmet needs. Implement robust and effective monitoring systems to track refusals across UCs evaluate the effectiveness of polio-plus initiatives over time.

- Evaluate long-term impact: Conduct third party studies to measure the sustained effects of integrated services on immunization rates, hygiene practices, and health outcomes.

6.1.7. G. Address flaws in program basics

Although PEI-EPI program has set benchmarks for improvement in recent times, there are few flaws in basics which need to be addressed for improved vaccination rates.

Revision of definition of Fully Immunized Child (FIC): The FIC definition needs to be revised—although fully immunized child refers to a child who has completed his vaccination up to Measles Rubella-1(MR1). It has been noted that parents tend to vaccinate their child up to MR1 (till 9 months) often refuse for OPV vaccination in subsequent SIAs citing that child as FIC. A clear message for mandatory vaccination of under 5 children during each SIAs up to 5 years of age on EPI cards should be printed. This will remove the misconception of parents regarding continuation of vaccination till the age of 5 years and allay their concerns of refusing for OPV vaccination in SIAs who have completed their vaccination up to MR1/IPV2/TCV vaccines. Few proposed changes in the EPI cards are:

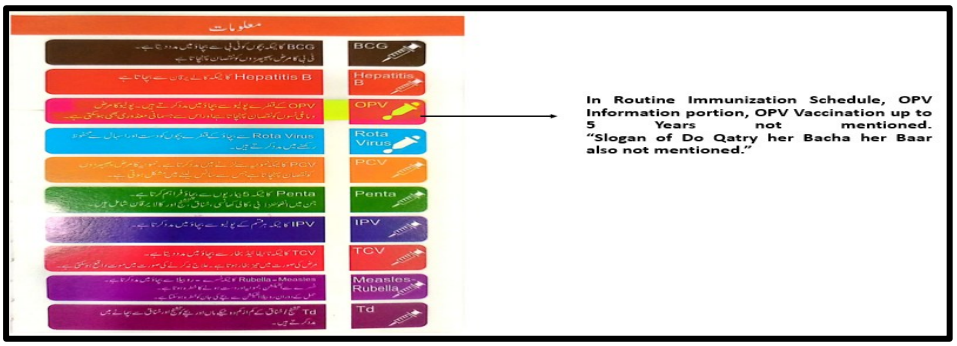
Figure 9

EPI Card Recommended Changes, Source: EPI Official website

- Inclusion of PEI logo alongside EPI logo on EPI card cover page.
- The back cover of EPI card does not mention up to what age OPV is to be administered to a child—it should be conspicuously mentioned for clarity. OPV vaccine status should be noted on EPI card as well in all campaigns irrespective of FIC status of the child.

Figure 10

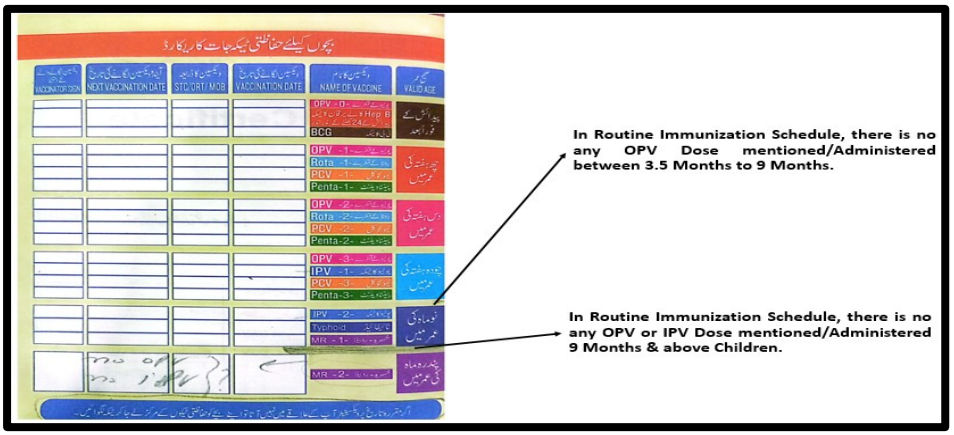
EPI vaccination card. Source: EPI Official Website



- OPV Vaccine shall also be given at 9 months and 15 Months of age.

Figure.11

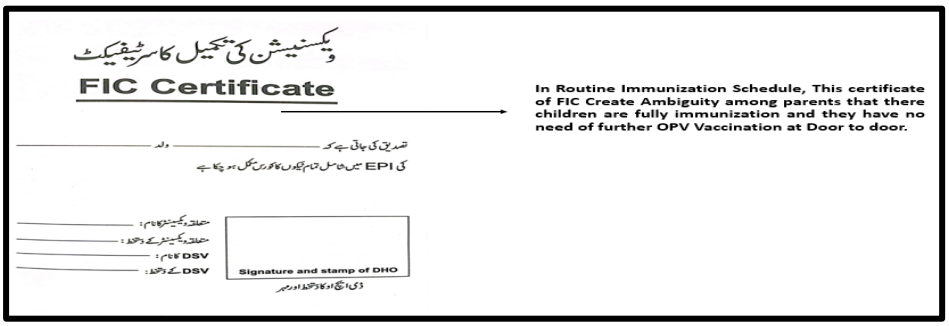
EPI vaccination card. Source: EPI Official Website



- Revision of FIC Definition Shall be made to address OPV vaccination related ambiguities.

Figure 12

EPI vaccination card. Source: EPI Official Website



6.1.8. H. Implementation of Sindh Immunization and Epidemics Control Act:

Sindh Immunization Act needs to be implemented to deal with families not accepting vaccination of their children despite concerted efforts by the government.

Polio awareness stamps on buses/trains/air tickets: It should be mandatory for transporters to print polio vaccination advocacy messages on tickets to sensitize the masses and create awareness.

1. Pre-departure certification of all passenger vehicles to and from Karachi: Currently the strategy has been implemented at Karachi bus terminal at Al-Asif Square however to interrupt viral circulation, buses moving in to or from Karachi must be subject to certify that all under 5 children are vaccinated. Failure to penal consequences for the transporter.
2. Disenfranchisement/barring services for the refusal families: In case families are not cooperating, they ought to be some consequences —SIM card blocking, school and madrassah admissions, blocking CNICs and issuance of passports, opening of bank account, provision of free birth certificate (s) should be made conditional to polio vaccination.

7. Future Research and Limitation's

This study, while insightful, has potential limitations that ought to be acknowledged at the outset. The findings may lack generalizability due to the geographic focus on five (5) union councils (UCs) and the relatively small sample size, which may not fully represent broader populations or diverse socio-cultural contexts. The variability in outcomes across UCs, such as the lower impact in Gujro D, suggests that unexamined local barriers, such as cultural beliefs or economic disparities, may have influenced results.

Additionally, the study primarily assessed short-term impacts, leaving questions about the sustainability of vaccine acceptance and hygiene behavior over time. The reliance on self-reported data introduces the possibility of response and recall biases, where participants may have overstated vaccine acceptance due to social desirability or inaccurate recollection. The absence of a control group limits the ability to attribute the decline in refusals solely to the soap incentive— concurrent health campaigns might have played a role. Moreover, the study's focus on hygiene incentives may have overlooked other critical barriers to vaccine acceptance, such as logistical challenges, misinformation, or safety concerns. Lastly, the underrepresentation of women, who are primary caregivers, and other demographic subgroups may have constrained the study's ability to fully capture the nuances of vaccine hesitancy and beneath the surface causes. These limitations highlight the need for further research to validate and build upon these findings.

Although this study was conducted in selected UCs of Karachi, the challenges it addresses—vaccine refusals, lack of trust in healthcare systems, and fragmented service delivery—are not unique to this metropolitan setting. These are province-wide concerns, particularly in underprivileged and high-risk communities across urban and rural Sindh. While healthcare infrastructure and social dynamics may differ in degree, the underlying patterns of mistrust, marginalization, and unmet basic health needs are consistently observed in provincial immunization and health service delivery reports (EPI Sindh, 2023).

Moreover, Karachi, as the most populous and diverse city in the province, serves as a microcosm of broader Sindh, with internal migration from rural districts and representation of multiple ethnic, linguistic, and socioeconomic groups. The study's approach—integrating maternal health, sanitation, and health education with immunization—responds directly to structural health system gaps common across Sindh, particularly in underserved areas of Hyderabad, Sukkur, Mirpurkhas, and Larkana.

The operational model tested in Karachi can serve as a pilot framework for replication and adaptation in other settings. While adjustments would be necessary based on local health system capacity and cultural context, the overarching strategy of bundled service delivery—grounded in community trust-building and responsiveness to local needs—remains relevant. Hence, this research offers scalable and adaptable lessons for public health planners across Sindh, provided future studies validate these interventions in diverse environments.

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Appendix: A

Table 1

WPV Polio Cases 2024 Sindh. Source NEOC official website

Province	District	Polio Cases
Sindh	Shikarpur	1
	Keamari	3
	Hyderabad	2
	East	1
	Sujawal	2
	Jacobabad	4
	Malir	1
	Mirpurkhas	1
	Sanghar	1
	Sukkur	1
Total		17

Figure 1

AKU findings Pakistan largest Immunization Survey-2021 1

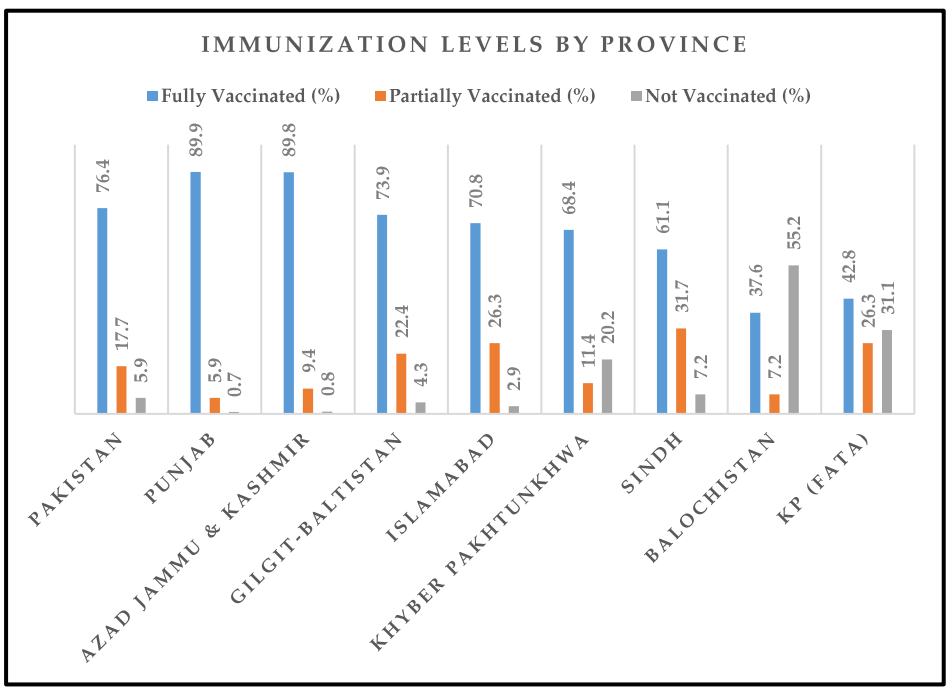

Figure 2

AKU findings of Pakistan largest Vaccine Survey 2023 1