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Reasons for non-vaccination and incomplete vaccinations among children in Pakistan

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ABSTRACT

Background: Global immunization efforts have received a boost through the introduction of several new vaccines. These efforts however, are threatened by sub-optimal vaccine coverage, particularly in countries with large birth cohorts. Pakistan has one of the largest birth cohorts in the world, where coverage of routine vaccination remains persistently inadequate. We undertook this study to ascertain reasons for non-vaccination or incomplete vaccination of children less than two years in 8 districts of southern Pakistan.

Methods: A cross-sectional survey using WHO recommended rapid coverage assessment technique was conducted in 2014. Using probability proportional to size method, we sampled 8400 households with eligible children (aged 4–12 months). Using a structured questionnaire, mothers or other primary caregivers were interviewed to determine vaccination status of an index child. In case of non-vaccination or incomplete vaccination, respondents were asked for reasons leading to low/no vaccine uptake.

Results: Based on both vaccination record and recall, only 30.8% of children were fully vaccinated, 46% had an incomplete vaccination status while 23%were non-vaccinated. The most frequently reported reasons for non-vaccination included: mothers/caregivers being unaware of the need for vaccination (35.3%), a fear of side effects (23%), mother/caregiver being too busy (16.6%), distance from vaccination centers (13.8%), and non-availability of either vaccinators or vaccines at vaccination centers (10.7%). Reasons identified for incomplete vaccination were similar, with caregivers being unaware of the need for subsequent doses (27.3%), non-availability of vaccinators or vaccines (17.7%), mother/caregiver being too busy (14.8%), fear of side effects (11.2%), and postponement for another time (8.7%).

Conclusion: Various factors result in non-compliance with vaccination schedules and vaccine refusal within the surveyed communities, ranging from lack of knowledge to non-availability of supplies at vaccination centers. These barriers are best addressed through multi-pronged strategies addressing supply gaps, increasing community awareness and enhancing demand for routine vaccination services.

1. Background

Global immunization efforts have received a boost through the launch of new vaccines and reduction in time lag of vaccine introduction between high and low income countries [1]. In recent years, more than 33 countries have successfully introduced rotavirus vaccine and more than 50 have introduced *Haemophilus influenzae* type b (Hib) and Pneumococcal Conjugate Vaccines (PCVs) in their routine immunization programs with the support of Gavi-The Vaccine Alliance [2]. However, suboptimal vaccine coverage, particularly in countries with large birth cohorts undermines these efforts.

Pakistan has one of the largest birth cohorts in the world with more than 5 million children born each year [3]. As an early adopter of new vaccines, Pakistan became the first country in South Asia to introduce Hib, PCV, and rotavirus vaccines (among Gavi supported vaccines) within her national program for routine immunization. Despite an expanded panel of childhood vaccines offered free of cost, suboptimal vaccine coverage presents a risk of continued disease outbreaks with associated morbidity and

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mortality. In 2012–2013, the Pakistan Demographic and Health Survey estimated fully vaccinated children aged 12–23 months constituted a mere 54% of eligible children, well below the required coverage of 90% by 2020 [1,4]. Interventions to address poor vaccine uptake within the population must be evidence-based and respond to local needs. There is a dearth of high quality published literature on reasons for vaccine refusal and suboptimal uptake of vaccines in low and middle-income countries, including Gavi supported countries. This study was conducted to ascertain reasons for low vaccine uptake, including non-vaccination and incomplete vaccination, within settled populations in southern Pakistan.

2. Methods

2.1. Study setting

Pakistan has one of the highest rates of infant and under five child mortality within South Asia, with 74 and 89 deaths per 1000 live births respectively [4]. Communicable diseases, particularly vaccine preventable illnesses contribute significantly to childhood morbidity and mortality, accounting for nearly 25% of childhood mortality [5]. Established as a national program to target childhood illnesses and subsequently devolved to provincial governments in 2011 [6], the expanded program for immunization (EPI) is tasked with providing free vaccination services to children under 2 years of age throughout the country.

This study was conducted in 8 districts of the province of Sindh, located in southern Pakistan, an area with an estimated population of 7 million [7]. This province was selected owing to its particularly poor performance in achieving EPI targets. Data from other provinces showed a sluggish increase in routine vaccination coverage, whereas vaccine coverage in Sindh showed a substantial decline from 37% in 2007 to 29% in 2013 [4,8].

2.2. Study design

A cross-sectional survey was conducted in 2014 using WHO recommended rapid coverage assessment technique for estimating vaccine coverage [9]. Among the selected 8 districts (Table 1), six had largely rural catchment populations, while districts Hyderabad and Karachi have a significant urban population. In Karachi, five peri-urban areas were purposively selected for the survey. Complete sampling frames for these peri-urban localities were available to the research team owing to earlier work done in these areas [10,11].

The EPI program offers a series of 9 vaccines from birth to 15 months of age (Table 2). Other than the measles vaccine, the vaccination schedule has to be completed by 14 weeks of age. Allowing time for catch up vaccination, the target population was children aged 4–12 months at the time of the survey.

Table 1
List of districts in Sindh included in the survey.

Name of district	Population
Karachi (five peri-urban areas)	249,128
Hyderabad	2,199,463
Matiari	769,349
Jamshoro	993,142
Thatta	979,817
Sujawal	781,967
Tando Muhammad Khan	677,228
Tando Allah Yar	836,887
Total	7,486,981

Table 2
Schedule of routine immunization provided through the expanded program of immunization in Pakistan.

Age of child	Immunizations
Birth	OPV 0, BCG
6 weeks	OPV I, Penta I, PCV I
10 weeks	OPV II, Penta II, PCV II
14 weeks	OPV III, Penta III, PCV III
9 months	Measles I
15 months	Measles II

OPV = oral polio vaccine; BCG = bacille calmette–guérin; Penta = pentavalent vaccine (diphtheria, pertussis, tetanus, hepatitis B, haemophilus influenza type B); PCV = pneumococcal conjugate vaccine valent 10.

2.3. Sampling technique and data collection

A Union Council (UC) is the basic structure of public administration and service delivery in Pakistan and a number of UCs combine to make a Taluka/Tehsil (sub-district). The number of UCs in each sub-district is variable. Districts and subsequently provinces are formed at increasing hierarchy. The 30 * 7 technique was applied at the sub-district level. Thirty clusters were selected from each sub-district and within each cluster seven eligible households were invited to participate in the survey. The desired number of clusters to be sampled from each UC within the sub-district was determined through population proportion to size (PPS), applied uniformly across all study districts and their respective UCs.

Household sampling was initiated from the center of each cluster, which was defined as a functioning government health facility offering routine vaccination services (e.g. basic health unit, rural health center or government dispensary). From the center, a random direction of movement was selected by spinning a pen on the ground and sampling in the direction the pen came to rest. Data collection teams moved 200 m away from the designated cluster center, in the identified direction and approached the first village in the direction of movement. The first residential structure within the village was identified and selected for sampling. If there was more than one public health center in each UC, a functional center located nearest to the geographical center of the UC was selected as the center point of the cluster for sampling.

From the first identified and surveyed household, seven eligible households were selected using systematic sampling, where every eleventh household was checked for eligibility i.e. where a child older than four months of age was living. If the household was eligible, an index child was enrolled in the survey. An index child was one eligible for enrolment i.e. aged 4–12 months at the time of the survey. In case of two or more eligible children in the same household, the youngest eligible child was enrolled. If the selected household was not eligible, the next door neighbor was selected and assessed for eligibility. To monitor field teams, Geographical Information System (GIS) coordinates were obtained at the cluster centre and each eligible household included in the survey.

Data were collected by trained research assistants hired from the districts being surveyed to ensure familiarity with the surveyed area and ease of communication, as selected staff had to be conversant in the local language, Sindhi. After explaining the research purpose and seeking consent for participation, mothers/primary caregivers of the index child were asked questions related to vaccination history, and in case of non-vaccination or incomplete vaccination of the child, they were asked for reasons. The section exploring reasons had open-ended questions allowing for the possibility of more than one answer depending on the caregiver's response (see Table 3). A picture of the EPI vaccination card, where available, was obtained using a mobile phone to verify the verbal vaccination history provided by mothers/caregivers. Vaccination

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