

IMPACT OF INFRASTRUCTURE ON IMMUNIZATION COVERAGE

The Government of Pakistan is the main provider of preventive health services in the country of which childhood immunization is one of the main services provided. Annually USD 240 million (PKR 2.2 billion) are spent on childhood immunization in Pakistan. Key expenditures in immunization include infrastructure, personnel, overheads and vaccines. This brief describes the structure of the Immunization Program and assesses the impact of some of the key inputs on the success of the program as measured by the extent of its coverage.

Routine Immunization Program

The Expanded Program on immunization (EPI) in Pakistan was started in 1978 to reduce morbidity and mortality from six vaccine preventable diseases¹. After the 18th amendment the Health Ministry has been devolved to the provinces along with programs such as EPI. At the provincial level the program is headed by the Provincial Program Manager (PPM) under the auspices of Director General Health, Secretary Health and Minister of Health. The PPM supervises the program through the Executive District Officer (EDO) Health at the district level. Each EDO has a designated EPI Coordinator at his district office who runs the technical and managerial aspects of the program. He supervises all immunization staff which includes district superintendent vaccination (DSV), assistant superintendent vaccination (ASV) and vaccinators. The DSV is based at the EDO office and is responsible for logistics as well as supervision of vaccinators. The ASV is based at the tehsil/ taluka level and is responsible for logistics and supervision. Each union council has 2 to 3 vaccinators who are based at the primary health care (PHC) facility and are responsible for conducting routine immunization in the facility as well as outreach. The EPI Coordinator, DSV and ASV are also responsible for routine visits to the PHC facilities and validate the record of vaccinator through random checking of immunizations conducted. Inadequate supervision and monitoring vaccinators' activities and validation of record has been observed in many areas and is a key factor to poor performance and low coverage. Additionally during polio campaigns, the monitors review the routine immunization status of children in addition to information on receipt of polio vaccine during the campaign. The vaccination teams travelling house to house note information on children under 1 year of age who have not received routine immunization. This data is compiled at the end of each campaign and is handed over to the concerned vaccinator for follow-up. This mechanism was put in place to support and strengthen routine immunization and in areas/ districts where this practice is followed an improvement in routine immunization coverage has been observed.

The vaccinator keeps a record of each vaccination; he uses a temporary register where all vaccinations are

SALIENT POINTS AND RECOMMENDATIONS

- Coverage data reported by vaccinators differs from coverage measurements by surveys. The differences are higher for BCG which is given at birth and is easily verifiable.
- A number of districts report coverage over 100% for many antigens. This could be due to high level of vaccine wastage or because the counts of children requiring vaccine provided to vaccinators is erroneously low.
- Mechanisms of monitoring and supervision should be improved to enhance coverage. Newer approaches such as electronic records keeping and analysis should be considered
- Number of vaccinators and their yearly target have no effect on vaccination coverage of a district, whereas distance to facility and parents investment into the child are key factors affecting vaccination coverage
- These findings suggest that traditional approaches such simply increasing investments in infrastructure and personnel without oversight on how they perform may not be helpful.

recorded, whether the child is from his catchment area or not. He also has a permanent register where vaccinations of children from his catchment population are recorded. This adds a double burden to his tasks whereby he has to reenter information from the temporary register. It has been observed that many a times this information is not transferred completely resulting in incomplete and unreliable records. The vaccinator fills out a monthly performance report which is submitted to the tehsil/ taluka headquarter i.e. ASV. This report is then sent to the DSV who compiles and put it up to the EPI Coordinator. The EPI Coordinator shares the reports with the EDO-H and sends a summary report to the PPM on monthly basis.

Factors Affecting Vaccination Coverage

A number of factors may impact vaccination coverage at the district level. Some of these factors are related to the workload on vaccinators. Predictors of vaccination coverage that have been identified in the literature include health worker/ vaccinator and nurse density/

¹ Ali SZ. Health for all in Pakistan: achievements, strategies and challenges. EMHJ 2000;6:832-7.

Table 1: Comparison of Vaccination Coverage Reported by EPI Program and PSLM and Factors Affecting Coverage

District	COVERAGE						PROGRAM FACTORS			
	BCG (PSLM)*	BCG (EPI)±	DPT3-Penta3 (PSLM)*	DPT3-Penta3 - Polio3 (EPI)±	Measles (PSLM)*	Measles (EPI)±	No. of Vaccinators±	No. of vaccinators per UC	Target Children 12-23m per Vaccinator±	Target Children 0-11m per Vaccinator±
Karachi	97	87	94	70	92	69	422	2	328	1138
Hyderabad	87	101	84	70	78	68	85	2	233	701
T.allahyar	67	94	67	87	67	78	29	2	36	679
Tando Muhammad Khan	43	112	43	99	43	92	40	2	8	407
Matiari	84	92	84	83	81	81	40	2	5	493
Thatta	68	103	66	78	64	73	145	3	64	315
Badin	67	89	66	76	64	73	134	3	57	348
Dadu	96	103	89	78	96	72	84	2	94	566
Jamshoro	92	113	92	97	91	95	65	2	86	384
Mirpurkhas	81	102	73	88	68	84	93	2	3	420
Umerkot	89	91	84	86	87	88	71	3	38	431
Sanghar	83	85	77	80	60	76	118	2	109	534
Tharparkar	71	79	48	73	62	66	99	2	100	419
Sukkur	80	106	81	88	78	84	121	3	26	331
Ghotki	76	84	74	80	65	67	82	2	103	546
Khairpur	77	100	76	94	74	88	160	2	43	418
Shaheed Benazir Bhutto	84	135	74	122	70	117	94	2	2	434
Nausheroferoz	75	120	67	102	62	97	117	2	14	353
Larkana	91	102	89	81	86	78	103	2	67	442
Kambar	88	99	84	70	83	69	76	2	96	553
Shikarpur	79	93	79	71	79	66	114	2	144	319
Jacobabad	62	97	59	78	57	65	80	2	119	371
Kashmore	71	92	72	63	76	72	76	2	29	360
TOTAL	79	95	75	78	73	75	2448	2	114	551

* Source: Pakistan Standard of Living Measurement (PSLM) Survey 2010-2011
 ± Source: Expanded Program on Immunization (EPI), Department of Health, Government of Sindh

workload, female literacy, area, income/ socio-economic status, distance to facility and delivery at home^{2,3,4}.

Data from EPI program, Government of Sindh and Pakistan Social and Living Standards Measurement (PSLM) Survey was used. There a total of 2448 vaccinators in Sindh province that vary by district depending upon the size of the target population. On average there are 20 vaccinators per taluka and 2 vaccinators per union council. On average there is one vaccinator for 551 children 0-11 months old and 114 children 12-23 months old. It is noteworthy that the EPI Program does not report the coverage of DPT3-Penta3 & polio 3 separately. The coverage of the two antigens has been observed to be different⁵.

For this analysis following factors were used to assess the impact on DPT3 vaccination coverage:

- Number of vaccinators by union council
- Target of 12-23 month old children per vaccinator per year
- Target of 0-11 month old children per vaccinator per year

- Proportion of population enrolled in schools (as an indirect indicator of how parents invest in their children)
- Proportion of population visited by Lady Health Worker
- Proportion of population which is employed
- Proportion of population seeking health care
- Proportion of population in the poorest quintile
- Proportion of population having >30 minute walking distance to nearest health facility

Table 2: Results of the regression for DPT3

Variable	Odds Ratio	95% CI	
		Lower Bound	Upper Bound
School Enrollment	1.16	1.00	1.34
Father's Employment	0.53	0.31	0.91
Distance to facility	0.81	0.69	0.95

Factors that were not significant: Number of Vaccinators (total), number of vaccinators per union council, number of children 12-23 months per vaccinator, number of children 0-11 months per vaccinator, Visitation by Lady Health Workers. Proportion of population that sought health care and proportion of population that is in the poorest quintile.

Association of each factor was checked with >80% DPT3 coverage and it was found that enrolment in school was directly and employment and distance to nearest health facility were indirectly associated. Factors such as the number of vaccinators did not impact the level of coverage in these districts.

2 Nath B, Singh JV, Awasthi S, Bhushan V, Kumar V, Singh SK. A study on determinants of immunization coverage among 12-23 months old children in urban slums of Lucknow district, India. Indian J Med Sci 2007;61:598-606

3 Ian T. Williams, Jack D. Milton, James B. Farrell and Neil M. H. Graha. Interaction of Socioeconomic Status and Provider Practices as Predictors of Immunization Coverage in Virginia Children. Pediatrics 1995;96:439.

4 Anand S, Bärnighausen T. Health workers and vaccination coverage in developing countries: an econometric analysis. Lancet, 369(9569);1277-1285;2007.

5 Pakistan Social and Living Standards Measurements (PSLM) Survey 2010-11. Available at www.pbs.gov.pk

Conclusions and Recommendations

Vaccination coverage as described by program records and measured on surveys is very different for BCG – which easily verifiable - than for other vaccines. Additionally a number of districts report coverage of >100%. This may be due to vaccine wastage (once opened a multi dose vial has to be wasted unless used within a specified time) or because the number of children requiring vaccination is far higher than the estimates provided to a vaccinator. Both may be true in different cases. Surely in districts where supra-coverage is described for all vaccines the latter must be considered. However the other concern is that often vaccinators wait at their facilities rather than going into the communities for outreach they must perform. This would decrease the children they can vaccinate and therefore lead to higher levels of wastage since once opened they must discard a multi-dose vial shortly.

Main factors that impact coverage of routine immunization are those that relate to physical distance to facilities and the level of investment by parents into the lives of their children. Factors such as the number of vaccinators and visitation by lady health workers – both factors that are directly influenced by health programs and are key health expenses do not contribute to levels of coverage.

These findings suggest that there is a need to address the work outputs of the vaccinators and lady health workers in promoting immunization. Specifically these would include how vaccinators (and lady health workers) conduct and record their daily activities, what (if any) targets do they meet what mechanisms exist to provide oversight to these frontline workers and what happens if targets are not met. Perhaps the use of electronic means of entering vaccination data at the point of contact may be considered.

Finally there is also a need to periodically assess if the targets assigned to vaccinators are accurate. Currently these targets are set based on estimates of population growth over the 1998 census. The formula of population growth that is applied is general and applies to the country as a whole and not to specific districts. Mechanisms such as rapid local population estimates may be undertaken periodically to provide more realistic understanding of the population that must be covered with health services such as vaccination. This may be possible during the course of the several surveys that are now conducted by or with the government.

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