

The Impact of Polio Eradication on Routine Immunization and Primary Health Care: A Mixed-Methods Study

Web Supplement

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ACRONYMS

AFP	Acute Flaccid Paralysis
ANM	Auxiliary Nurse-Midwife
ASHA	Accredited Social Health Activist
CARE	Cooperative for Assistance and Relief Everywhere
DHS	Demographic and Health Survey
DIO	District Immunization Officer
DM	District Magistrate
DTP3	Third Dose of Diphtheria, Tetanus, and Pertussis Vaccine
EPI	Expanded Programme on Immunization
GAVI	Global Alliance for Vaccines and Immunization
GPEI	Global Polio Eradication Initiative
HIV	Human Immunodeficiency Virus
IHME	Institute for Health Metrics and Evaluation
IPD	Immunization Plus Day
LQAS	Lot Quality Assurance Sampling
MICS	Multiple Indicator Cluster Survey
OPV	Oral Polio Vaccine
PHC	Primary Health Care
PSLM	Pakistan Social and Living Standards Measurement
RI	Routine Immunization
SIA	Supplemental Immunization Activity
SITE	Sindh Industrial and Training Estate
SNNP	Southern Nations, Nationalities, and People's Region
TSC	Technical Steering Committee
UN	United Nations
UNICEF	United Nations Children's Fund
USD	United States Dollar
VPD	Vaccine Preventable Disease
WHO	World Health Organization

1. BACKGROUND

1.1 Study Rationale

Polio eradication is a 20-year, \$9-billion-dollar project that has harnessed the work of an estimated 20 million people (1,2). In 2001 alone, the GPEI vaccinated about 575 million children against polio in 94 countries, most of them multiple times (3). The GPEI gained international support at its inception in 1988 in part because of the argument that such mass polio vaccination campaigns could mobilize support and resources for routine immunization (RI) and primary healthcare (PHC) (4–8). But whether the effects of the GPEI on health systems have proved positive or negative has been debated ever since (9,10).

Over the past twenty-five years, there have been a number of studies on the impact on polio eradication efforts on PHC and RI. A larger scale study in the 1980s found a positive effect of polio eradication activities on health systems in the Americas, but health infrastructure in most of these countries was already strong relative to that in developing countries in Asia and Africa (11). Studies in Egypt, the Philippines, and WHO's Western Pacific Region in the mid-90s showed that the initial implementation of polio eradication activities had positive effects on immunization more generally (12–14). Another study conducted in 2002 found that acute flaccid paralysis (AFP) surveillance resources were used in the surveillance of and response to other diseases in Africa (15). Other, small-scale studies of the effect of GPEI on RI and PHC have provided equivocal or mixed results (16–19).

A study in Tanzania, Nepal, and Laos carried out in the late 90s showed that polio eradication activities had positive effects in some areas and negative effects in others: for example, new health infrastructure was created in Laos, but mass polio campaigns interfered with the timing of family planning activities in Nepal (20–22). Another study in India around the same time found positive effects in a number of arenas, but noted some negative impacts due to disruption of normal activities caused by the campaigns (20,22).

These studies revealed that the relationship between polio eradication activities and other health services was highly context-dependent. In some times and places mass vaccination campaigns – and their attendant planning, monitoring, and surveillance activities – had positive effects, while in other times and places their effects were negative. But a systematic analysis that determined where and when polio eradication activities have positively and negatively impacted RI and PHC, followed by research on what mediates these outcomes in particular contexts and thus how they might be changed, was needed.

In 2011, the Bill & Melinda Gates foundation commissioned a study to assess the impact of polio eradication efforts on RI and PHC. The study design was to include a quantitative analysis, as well as identify synergies between polio eradication, RI and PHC, and provide recommendations on how best to leverage these gains.

To select a protocol for funding, help guide the design, and ensure objectivity and scientific rigor, the foundation invited nine individuals to participate on a Technical Steering Committee (TSC). The TSC is comprised of individuals who are experts in quantitative study design and/or program design, and its members represent a wide range of organizations in diverse locations¹.

The TSC selected this protocol for funding via a competitive two-step application process: (1) an open call for letters of invitation; and (2) invitations to four candidates to submit full proposals based on the letters received. The TSC then selected the group to conduct the study based on a pre-defined set of scored criteria.

Throughout the course of the study, the TSC has been actively engaged, meeting as a group on a bi-monthly basis to review the study design, discuss progress, and review and provide feedback on the methods, findings, and

¹ TSC members include: Mercy Ahun, Managing Director, Project Delivery, Global Alliance for Vaccines and Immunizations; David Bishai, Professor/Coordinator of Health Economics, John Hopkins Bloomberg School of Public Health; Logan Brenzel, Independent Consultant, Bill & Melinda Gates Foundation, World Bank, and USAID; Elias Durry, Medical Officer, Global Immunization, Center for Disease Control and Prevention; Rashid Joorna, Director of General Health, Pakistan Ministry of Health; Grace Natson; Peter Nsubuga, Global Public Health Solutions; Muhammad Pate, Minister of State for Health, Nigeria; and Naveen Thacker, Director, Deep Children Hospital and Research Centre, Gandhidham, and Member, Global Alliance for Vaccines and Immunizations Constituency Steering Committee.

articulation of final results. Importantly, individual TSC members gave additional support in facilitating the country case studies.

1.2 Research Team Composition

Middlebury College carried out the study in collaboration with ISciences, LLC and CARE International. As the lead partner, Middlebury coordinated all activities, carried out the majority of the qualitative research, analyzed qualitative data, and generated materials summarizing results (with incorporated feedback and insight from partners). ISciences was responsible for designing and carrying out quantitative analyses on the effects of the maturity and intensity of polio campaigns on RI and PHC. CARE led qualitative research in Camucuo, Angola and Nizamabad, India, assisted in the Rubavu, Rwanda and South Omo, Ethiopia case studies, and generated communications materials.

1.3 Hypotheses

Based on a review of the existing literature, we formulated the following hypotheses:

Hypothesis 1a. There will be an **initial effect of scale-up** of polio eradication activities. We further hypothesized that this effect would be largely positive for RI and not significant for other measures of PHC. Potential mediators of these effects are described in h2a, below.

Hypothesis 1b. After the initial effect, there will be **intensity-related effects** tied to the number of polio vaccination campaigns per year in a given area. We hypothesized that at low levels of intensity (e.g., 3 campaigns per year), diversion of energy effects would be minimal, and campaigns would be associated with improvements in RI and PHC due to quality improvements described in h2a, below. However, we hypothesized that at high levels of intensity (e.g., 8 campaigns per year), diversion of resources, personnel, and attention will cause RI and PHC to suffer, as described in h2b, below.

We hypothesized two major types of mediators of the impact of polio eradication activities:

Hypothesis 2a. The positive impact of polio eradication activities on RI and PHC will be mediated by the creation of improved quality health systems, including: quality of surveillance (9,11,13,14,23); increased outreach to low-income, mobile, and other marginal populations (12); supervision and accountability of front-line workers (11,21,22); quality of cold chain (21,23); increased high-level attention to and funding for vaccination, in part because it contributes to the overall level of polio immunity in a country (12,13); increased health worker motivation due to involvement in a historic program; and increased public awareness of the health system due to social mobilization and/or contact with health workers (11–13,16,20–22).

Hypothesis 2b. The negative impact of eradication activities will be mediated by the intensity and quantity of polio eradication activities: health worker "fatigue" due to repeated immunization campaigns; diversion of high-level attention away from RI and PHC (21); public dissatisfaction with a health system whose most public face focuses on only one disease; diversion of worker time and energy due to mass vaccination campaigns (21,24–26); and service interruption of RI and PHC during polio campaigns.

The figure below summarizes our hypotheses.

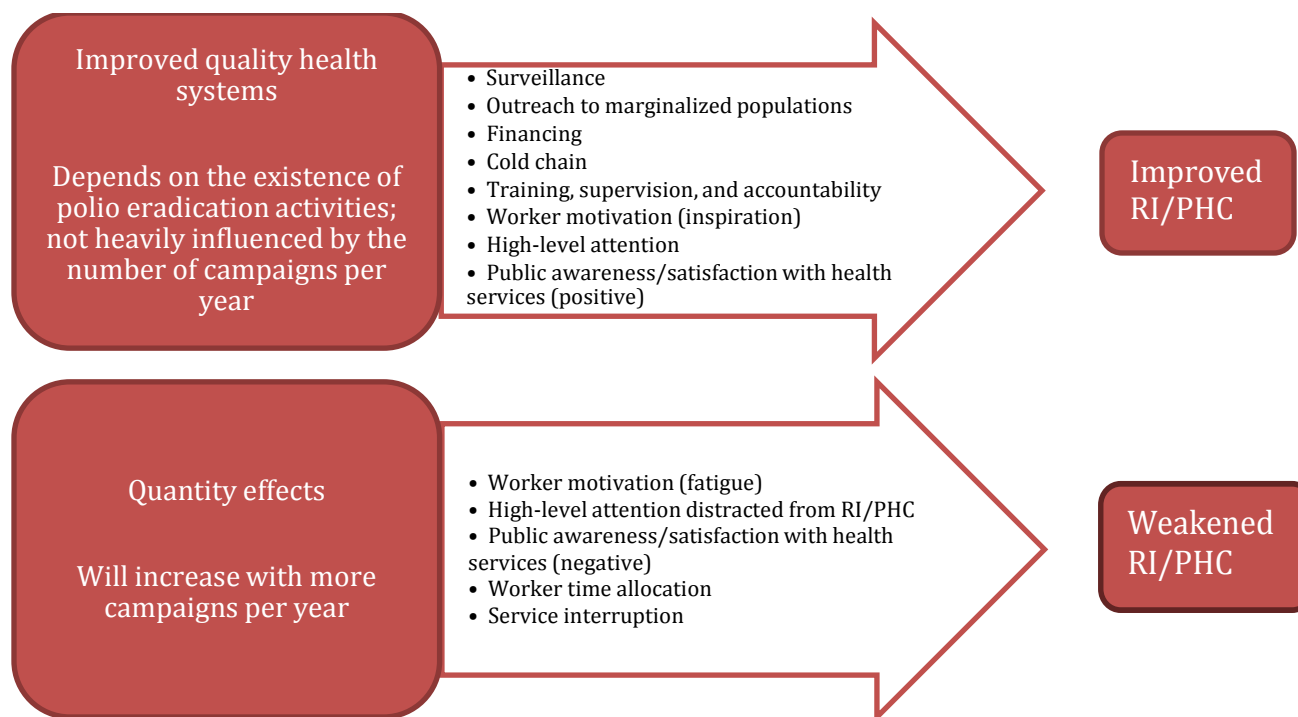


Figure 1. Study hypotheses.

In this report, we first describe the results of quantitative analyses assessing Hypotheses 1a and 1b. Next, we review qualitative evidence regarding the hypothesized mediators of the relationship between polio eradication activities, RI, and PHC.

Defining PHC for this Study. Primary health care has many definitions (27). Perhaps the most influential can be found in the Declaration of Alma-Ata:

Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process. (28)

While we endorse this broad definition of PHC, we were forced to narrow and clarify it in order to operationalize PHC in our research. More limited definitions were needed to facilitate comparison across contexts.

In our quantitative work, we primarily used maternal health indicators as a proxy for PHC, because they are some of the few indicators with reasonably reliable and comparable data across time and space. We acknowledge that such indicators are only a small subset of PHC, and a poor proxy for the ideal of PHC defined more broadly, but we were limited in our quantitative work by the data available.

In our qualitative work, we defined PHC as the provision of health care at the basic health unit level and below (community health workers, health extension workers, and the activities of the lowest rung of health department facilities all count as PHC). We also considered the following activities, also outlined at Alma-Ata, when polio eradication activities influenced them:

Education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning... prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs (28).

We accept that this definition leaves out a broad range of activities that could and should constitute PHC in a broad sense—like education or income redistribution. However, this limited definition was a way to operationalize the term to facilitate comparisons across very different contexts, and to focus attention in the short time period available for our case studies.

Defining RI for this Study. For the quantitative analyses, the study primarily used data on the coverage of the third dose of diphtheria, tetanus, and pertussis vaccine (DTP3) as a proxy for RI. DTP3 is a commonly used proxy for RI coverage (29). In the Pakistan analysis, in addition to evaluating DTP3 coverage, we evaluated OPV3 coverage from a dataset that did not include information on DTP3.

In our qualitative work, routine immunization referred to the provision of vaccinations children were scheduled to receive during their first year of life. This varied from case study to case study according to each country's official vaccination schedule.

2. METHODS

2.1 Methodology Overview

We used a blend of qualitative and quantitative methods to examine the relationship between polio eradication efforts, RI, and PHC. Additional detail beyond that provided here is available in an open-access article describing our methods (30).

2.2 Quantitative Methods

To evaluate hypotheses 1a and 1b on the effects of the maturity and intensity of polio campaigns on RI and PHC, we carried out five suites of quantitative analyses. One analysis was global and used the country as the unit of analysis; in addition, we carried out subnational analyses on Nepal, India, Pakistan, and Nigeria, countries where we conducted qualitative case studies. As described below, sufficient data to run analyses in the other countries where we carried out qualitative case studies—Ethiopia, Rwanda, and Angola—did not exist or was not made available.

The methods used for each analysis we carried out are described in detail in our results section, but our general analytic strategy, tailored for each analysis, can be represented by the equation $H_{t2} = f(H_{t1}, M, I, C)$ where: H_{t2} is the percentage coverage of a given measure of RI or PHC at the end of a given period of observation (e.g., a 3-year period of time); H_{t1} is the percentage coverage of that measure at the beginning of the time period; M is the maturity of polio eradication efforts within a country as measured by the amount of time since the first house-to-house campaign; I is the intensity of polio eradication activities as measured by the number of campaigns within a given period of time; and C refers to contextual variables such as school enrollment rates, income levels, prevalence of atrocities, and regime type, as well as levels of GAVI Immunisation Services Support and other health spending (31–36).

2.3 Qualitative Methods

To evaluate hypotheses 2a and 2b on the mediators of the relationship between polio eradication activities, RI, and PHC, we carried out a six-week case study in each of the selected districts. To ensure that we collected the same information in our case studies, we followed a standardized protocol at each site, yielding truly comparable information. A full description of our qualitative methodology is available in the Qualitative Research Guide (37).

Researchers carried out the following activities at each research site:

- A comprehensive document review, including polio-related, RI-related, and PHC-related planning and evaluation documents and national health systems funding documents
- Semi-structured interviews (adhering to a standardized protocol) with the following interviewees:
 - National-level officials at the Ministry of Health, WHO, UNICEF, and other agencies if appropriate (n=10)
 - District health leadership, including government officials, and WHO/UNICEF staff if applicable (n=5)
 - Frontline health staff, including staff working on polio, RI, and PHC (n=30)
 - Community members encountered during the campaign (n=5)
- Participant observation in the following activities:
 - Planning, implementation, and monitoring and evaluation of a polio campaign
 - Surveillance activities
 - Clinic observation both during and outside of campaign dates
 - Other RI and PHC activities as applicable

While the protocol included national-level interviews and document review, then, we focused on evaluating impacts at the district level. This means that we gave greater focus to district-level effects such as worker time allocation, and less attention to national-level effects such as the development of lab facilities. The documents, interview transcripts, and participant observation fieldnotes were collected and coded using the qualitative analysis program NVivo. Over 50 codes and sub-codes were used to evaluate the hypothesized mediators between polio eradication, RI, and PHC, and facilitate comparison of the provision of polio, RI, and PHC services across contexts.

2.4 Case Study Selection

Our qualitative work was based on eight district-level case studies that examined the relationship between polio eradication, RI, and PHC. Because this relationship is complicated and highly context dependent, these case studies aimed to provide an **in-depth understanding of this relationship in the case study district, not in a country as a whole.**

In choosing our study districts, we used the following criteria:

1. Study districts were to be divided between the two major regions of ongoing polio transmission—South Asia and Sub-Saharan Africa.
2. Because our study protocol included participant observation in a campaign, study sites needed to have a **polio campaign in early 2012** so that we could conduct participant observation. (The exceptions to this were our two pilot districts—Rautahat, Nepal, and South Omo, SNNP, Ethiopia—where we conducted participant observation in November to evaluate the effectiveness of our research protocol.)
3. In a previous study, the relationship between polio eradication and other health services was affected by the general strength of health services in the area (21). Therefore, our case studies were selected to represent a **range of levels of provision of RI and PHC**, as shown in the table describing our case studies below. For the purposes of site selection, we used the following variables from the most recent demographic and health survey (DHS) in each country:
 - RI indicator: percentage of children who had received a third dose of DTP
 - PHC indicators: levels of antenatal care and attended births
4. Since one of our hypotheses was that the intensity of polio eradication campaigns (number of campaigns per year) influences the relationship between polio eradication, RI, and PHC, we selected case studies to represent a **range of campaign intensity**. Some of our case studies experienced as few as 2 campaigns per year; others experienced as many as 11.
5. The availability of an experienced researcher to carry out work in a given region was taken into consideration.
6. Since DHS data allows regional-level but not district-level resolution, the above process led us to *regions* that fit our pre-defined criteria. Within those regions, the final selection of *districts* for case studies was carried out by the case study researcher in conversation with the government of the country in question.

Our case studies are drawn from regions with ongoing polio eradication activities, and do not represent the current or historical experience of regions of the world (such as the Americas or the Western Pacific) where polio was relatively quickly eliminated. Research conducted in these regions in the late 1990s found largely positive impacts of polio eradication activities in these areas, which overall had relatively strong routine immunization systems in place (11,12).

Details on the selected case studies are presented in Table 1.

Table 1. Description of case study locations.

Case study district	# of polio campaigns in 2011	Last polio case	Attended births in region by TBA or higher	Ante natal care coverage in region	DTP3 coverage in region	About the case study area
Camucuio, Angola	4	1999	59% (2001 MICS)	83% (2001 MICS)	27% (2001 MICS)	Camucuio is located in Namibe province, where the desert terrain allowed the area to remain reasonably untouched by nearly three decades of civil war. However, throughout the country, health services remain weak and there are relatively few doctors to serve the population. Unlike many African countries, Angola's health care system is less dependent on foreign assistance, with 80 percent of health expenditure covered by the country's public sector.
Kumbotso, Kano, Nigeria	8	2012	38% (2008 DHS)	32% (2008 DHS)	9% (2008 DHS)	Kano, Nigeria, is a site of ongoing polio circulation. At the time of our case study in early 2012, there was significant unrest in the area, with well over 100 deaths in bombings in the city as a whole in January. Health services in the region that includes Kano, in northern Nigeria, are weak; the area has by far the lowest DTP3 coverage figures of any case study. Further, historically the area has been a site of polio vaccine refusal, with polio campaigns suspended entirely for a period in 2003-2004.
Rubavu, Rwanda	1	Pre-2001	73% (2005 DHS)	93% (2005 DHS)	80% (2005 DHS)	Rwanda is a small country with a relatively strong system for RI and PHC provision. There have been no polio cases anywhere in Rwanda since before 2001, and the country has never implemented a high number of polio campaigns.
South Omo, SNNP, Ethiopia	2	Pre-2001	7% (2011 DHS)	42% (2011 DHS)	38% (2011 DHS)	South Omo is a remote border region of Ethiopia's SNNP province. Largely rural, South Omo is home to a number of mobile and nomadic populations. There has been no polio case in the region in the last 10 years.
Nizamabad, Andhra Pradesh, India	2	Pre-2000	93% (2006 DHS)	96% (2006 DHS)	61% (2006 DHS)	Nizamabad is located in Andhra Pradesh, one of India's better-performing states for health services coverage. In contrast to Purba Champaran, Nizamabad has not seen persistent polio transmission (no polio case has been found in Nizamabad since before the year 2000), and thus experiences only a few campaigns per year.

Purba Champaran , Bihar, India	9 to 10	2010	95% (2006 DHS)	34% (2006 DHS)	46% (2006 DHS)	Purba Champaran, Bihar, is in a region that harbored persistent polio transmission until the elimination of poliovirus from India in 2011. As such, it experiences a high number of polio campaigns. While the quality of health services generally has improved in Purba Champaran over the past few years, and the current figures are likely better than those reflected in the last (and now outdated) DHS survey, it still has low levels of provision of maternal health care and RI coverage in comparison to other parts of India.
Rautahat, Nepal	4	2010	40% (2011 DHS)	84% (2011 DHS)	87% (2011 DHS)	Located in the Terai, or plains, of Nepal (and directly across the border and contiguous to Purba Champaran), Rautahat harbored Nepal's last polio cases in 2010, and represents one of Nepal's most high-risk areas for polio. Compared to other areas of Nepal, Rautahat is weak in terms of coverage of RI and PHC services.
SITE Town, Karachi, Pakistan	11	2011	93% (2007 DHS)	71% (2007 DHS)	48% (2007 DHS)	Located in the urban center of Karachi, Pakistan, SITE Town has harbored ongoing polio transmission. SITE is home to large populations of Pashto-speaking migrants, and at the time of our research was experiencing significant security problems. The SITE case study illustrates the dynamics at play in an area with weak health systems, large minority populations, and security issues.

2.5 Methodological Limitations and Challenges

The methodology outlined here allowed us to systematically compare the relationship between polio eradication efforts, RI, and PHC in a variety of contexts, and draw conclusions about that relationship more generally. However, as is to be expected when working in seven different developing countries on a short time-frame, we did experience some limitations in our ability to carry out our protocol exactly as planned.

The most significant limitation was the availability of information for our quantitative analysis on when and where polio campaigns have occurred. The WHO office in Geneva was kind enough to provide us with this information at the global level. In the cases of Pakistan, Nepal, and Nigeria, we are grateful to the countries involved for their openness and willingness to share this data; and in the case of India, we are grateful that this data was made publically available on the country's National Polio Surveillance Project website. However, in Ethiopia, Rwanda, and Angola, such data either did not exist, or we were unable to access it. Thus, despite our best efforts, we were unable to conduct quantitative analyses on data from those countries.

The study is grateful to the governments of our case study countries for their permission and support for our work. In general, we collected the same information from all sites as planned. However, in certain cases, we were forced to scale back the collection of qualitative data because of security issues. We feel such limitations are acceptable in a study committed to both the collection of data in a true range of contexts, and the personal safety of our staff.

3. RESULTS: QUANTITATIVE ANALYSIS

In this section we present the results of our quantitative analyses examining the effect of the initiation and number of polio immunization campaigns on indicators of RI and maternal health care. In the material that follows, we demonstrate **a number of statistically significant correlations** relating polio eradication campaigns to outcomes in RI rates and measures of maternal health care. However, **the effects we observed were generally small relative to confidence intervals** and there were **data and design limitations** that severely limited our ability to attribute causality to polio eradication campaigns. Therefore, **we consider the results of our quantitative analysis inconclusive**. To the degree that polio eradication campaigns have an effect on outcomes in RI and maternal health care, these effects are small relative to other factors, and inconsistent from place to place. This finding reinforces the qualitative conclusions that effects of polio eradication campaigns were mixed, and that opportunities to systematically strengthen health systems in polio-endemic areas often remained missed.

3.1 General Approach

We performed two major genres of analysis. Cross-national analysis used annual country-scale data on polio eradication campaigns, RI, maternal health care, and related covariates. In addition, we performed country-specific analyses for India, Nepal, Pakistan, and Nigeria. These country-specific analyses allowed us to assess the state/province- and district-level effects.

All of our quantitative analyses followed a common approach that was tailored for each of the analyses described below. This general approach focused on explaining changes in three indicators over time: the percentage of children in a given age cohort that have received a third dose of diphtheria, tetanus, and pertussis vaccine (DTP3); the percentage of births assisted by a traditional birth attendant or more skilled personnel; and the percentage of pregnancies for which the mother received some level of antenatal care.

Our analyses examined the rate of change in these three dependent variables over time, while controlling for:

- The initial levels of the dependent variable;
- The maturity of polio eradication efforts as measured by the number of years that have elapsed since the first house-to-house supplemental immunization activity (SIA) for polio eradication;
- Contextual variables that may also explain changes in the dependent variable over time (e.g., education levels, travel time to access potable water, health care expenditures, political instability);
- Other public health campaigns (e.g., measles vaccination campaigns; antihelminthic medication campaigns, etc)

This general analytic framework allowed us to test hypotheses about the relationship between polio eradication campaign intensity and the rate of change in the RI and maternal health indicators over time. The basic modeling strategy used step-wise regression to fit a parsimonious model using only likely covariates and then systematically tested alternative model specifications that augment the baseline model with specific measures of polio eradication (i.e., time since first campaign and number of campaigns per year). We could then evaluate the magnitude and direction of the partial effect of polio eradication measures as well as the proportion of variation explained by RI and maternal health outcomes.

3.2 Data Limitations

Quantitative analysis of the effects of polio eradication campaigns on RI and maternal health care proved challenging. First, polio campaigns were implemented across most of South Asia and Africa at about the same time, meaning controlling for time period effects when evaluating the effects of initiating polio eradication activities was difficult (22). Second, polio eradication campaigns occurred concurrently with other public health and development initiatives, such as decentralization and global shifts in RI policy, which confounded the effects (22). Third, the implementation of polio eradication campaigns has evolved considerably over time. The most obvious change was that early campaigns were virtually all national in scope. Over time, targeting evolved to focus on first level administrative units (states/provinces) and then second level administrative units (districts). As targeting became more sophisticated, regions with relatively low levels of RI and maternal health care coverage generally had the most frequent polio eradication campaigns. This created a selection bias that made it very difficult to establish causality between the frequency of polio eradication campaigns and changes in RI and maternal health care coverage. Finally, there were limitations in the availability and quality of data to support quantitative analysis. Some

analysts have suggested that data in national reports of RI and PHC indicators are faulty and/or biased (38–40). Our quantitative analyses addressed each of these challenges to the extent possible, but the compound effects of these issues, combined with the small effects we were able to detect, severely limited our ability to make conclusive statements based solely on quantitative analysis.

3.3 Global Cross-National Analysis

In the global cross-national analysis, we examined two distinct effects of polio eradication campaigns on measures of RI and maternal health care within countries: 1) a hypothesized ‘scale-up’ effect, where there was an initial benefit due to the establishment of the polio eradication campaigns; and 2) the impact of campaign intensity.

Our approach to examining both was to use regression, evaluating the effects of polio eradication campaign intensity on measures of RI and maternal health care within countries, while statistically controlling for competing trends that may also have simultaneously affected these measures, such as other health care initiatives, increased funding, or political instability.

What impact did the initiation of polio eradication have on RI and maternal health care?

Figure 2 illustrates the partial effects of campaign maturity (number of years since first house-to-house campaign) on two estimates of DTP3 coverage from the World Health Organization (41) and the Institute for Health Metrics and Evaluation (38) and an estimate of attended birth coverage (42). Each line depicts the predicted values from regression models fit to restricted cubic splines, in the presence of covariates. All additional covariates were set at median values.

In the two graphs for DTP3 coverage, colored lines indicate different starting values of coverage at time zero chosen at quintiles of initial values of coverage. These results indicate that the start of the **polio eradication efforts was associated with an increase in DTP3 coverage**, especially for those countries that had low initial values of DTP3 coverage (blue lines), but also for other countries. Similarly, there was an increase in attended birth coverage that was correlated with polio eradication campaign maturity.

However, it is important to note that these increases appear to have started prior to the onset of polio eradication campaigns and were sustained for up to 10 years or longer following the onset of campaigns. This long timeframe suggests that other unmeasured factors may have also influenced DTP3 and attended birth coverage during this time. Most countries in our analysis experienced the start of polio eradication campaigns around the same time (c. 1996). Therefore, the number of years since the first campaign (campaign maturity) was highly correlated with year, meaning that this **result may be due to other changes that co-occur with the initiation of polio eradication campaigns such as decentralization initiatives or global policy or funding shifts unaccounted for in our analysis.** As a result, **it is not possible to unambiguously attribute changes in DTP3 to initiation of polio eradication campaigns.**

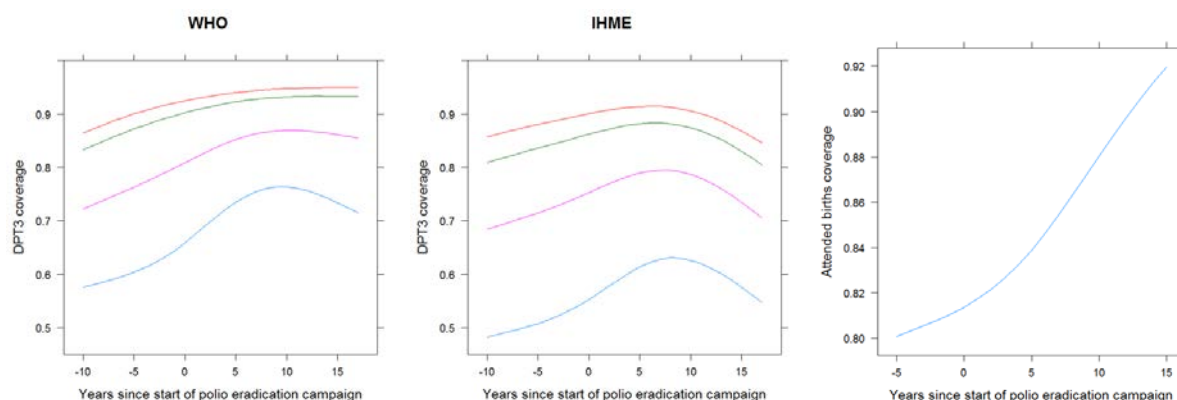


Figure 2. Effect of the onset of polio eradication campaigns on DTP3 coverage from two different sources, World Health Organization (WHO; left side) and Institute for Health Metrics and Evaluation (IHME; middle) and on attended birth coverage (right side).

What impacts did the number of campaigns per year have on RI and maternal health care?

Figure 3 illustrates the partial effect of polio eradication campaign intensity on DTP3 and attended birth coverage. Solid lines indicate different levels of initial coverage (1st quartile, median, 3rd quartile). Dotted lines represent 95 percent confidence intervals. Partial effects for both dependent variables were very similar for an alternate measure of campaign intensity, percentage of under-five population targeted (not shown).

The range of campaign intensities shown here was associated only with very small changes in DTP3 coverage. Although statistically significant (for IHME-based coverage only, not WHO-based coverage), these changes were unlikely to be meaningful effects.

With regard to attended births coverage, countries with low initial levels of campaign intensity experienced an increase of roughly 10 percentage points as the number of campaigns increased from 0 to 2, consistent with the scale-up effects described above. However, note the widening of the confidence intervals in both graphs for higher initial values of coverage (pink and green lines). These expanding intervals resulted from the lack of observations at high levels of campaign intensity for countries and highlight the selection bias that complicates interpretation of these analyses.

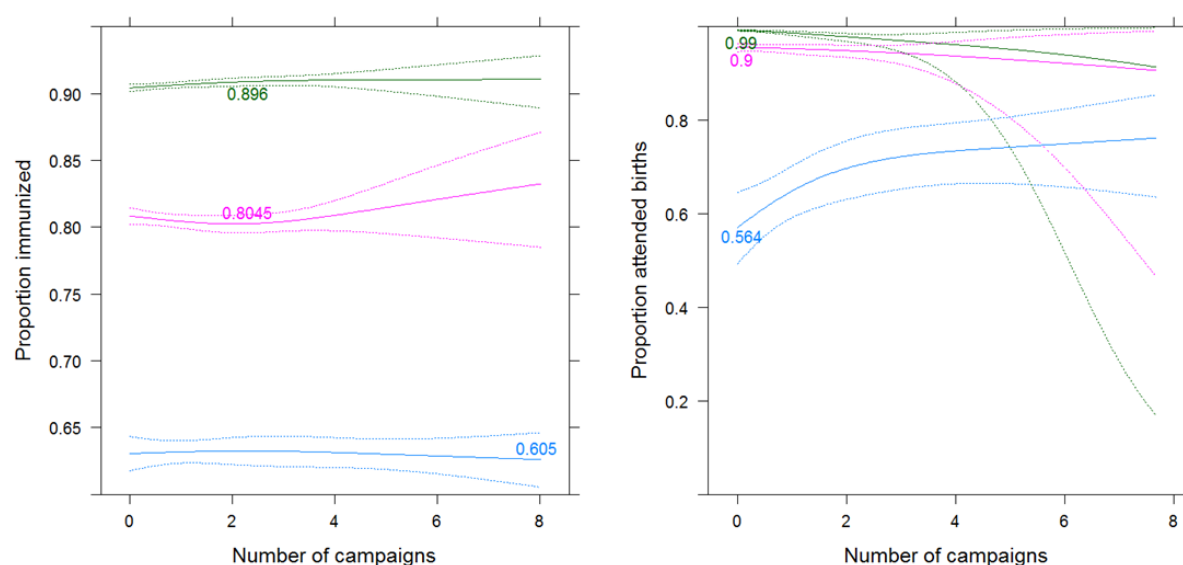


Figure 3. Effect of polio eradication campaign intensity on DTP3 immunization coverage (data from Institute for Health Metrics and Evaluation, IHME; left side) and on attended birth coverage (right side).

3.4 Country Specific Analyses

India. The India analysis examined the effects of polio eradication campaign intensity on measures of RI and maternal health care derived from Demographic and Health Surveys (DHS) conducted in 1998-99 and 2005-06 for 26 states (43,44). There was no variability in campaign maturity within India since polio eradication began with national immunization days. As a result, the analysis assessed the impact of polio eradication campaign intensity on two measures of DTP3 coverage (one for children ages 12-23 months and the other for children ages 12-59 months at the time of the survey), attended birth coverage, and antenatal care coverage (both for children ages 0-59 months at the time of the survey).

Figure 4 depicts the partial effects of polio eradication campaign intensity on each of the four measures of RI and maternal health care coverage. Blue lines hold the initial level of coverage fixed at the 1st quartile, magenta lines at the median, and green lines at the 3rd quartile. Each line is labeled with the assumed value of initial coverage. Grey bands indicate the 95 percent confidence interval.

The result of the India analysis for DTP3 was inconclusive. In terms of statistical significance, the models were significant at just under the 95 percent confidence level for DTP3 (12-23) and at the 98 percent confidence level for DTP3 (12-59). The model for DTP3 (12-23) made only modest improvement in adjusted R^2 relative to a model without polio eradication campaign intensity (0.77 vs. 0.74) and the model for DTP3 (12-59) exhibited a stronger improvement (0.77 to 0.84). Figure 4 also indicates that the nature of the partial effects of polio eradication campaign intensity was consistent for each measure of DTP3. For regions with median and better initial coverage, the coverage declined with up to four campaigns per year for DTP3 (12-23) and up to three campaigns per year for DTP3 (12-59). However, these effects were small relative to the confidence intervals and one can draw a straight line through all three of the confidence intervals for DTP (12-23) and can almost draw a straight line through the confidence intervals for DTP3 (12-59). In addition, the analysis was clearly affected by a strong selection bias in which regions with median and above initial coverage rates received fewer polio eradication campaigns (as demonstrated by the rapid widening of the confidence intervals with increasing campaign intensity). **The statistical significance and non-linear relationships in these models were likely an artifact that was driven by this selection bias.**

The results of the analysis for attended births and antenatal care were also inconclusive. In both cases, an alternate independent variable (maternal educational attainment at the end of the time period) provided a more significant result and absorbed the significance of campaign intensity. While the partial effects of campaign intensity on attended births suggested a downward trend with greater intensity, the effects were small compared to the confidence interval and (as above) were likely an artifact of the selection bias. Similarly, the results for antenatal care suggested that low levels of polio eradication campaigns increased coverage in regions with lowest initial coverage. Again, these effects were small relative to the confidence intervals and were likely an artifact of the selection bias.

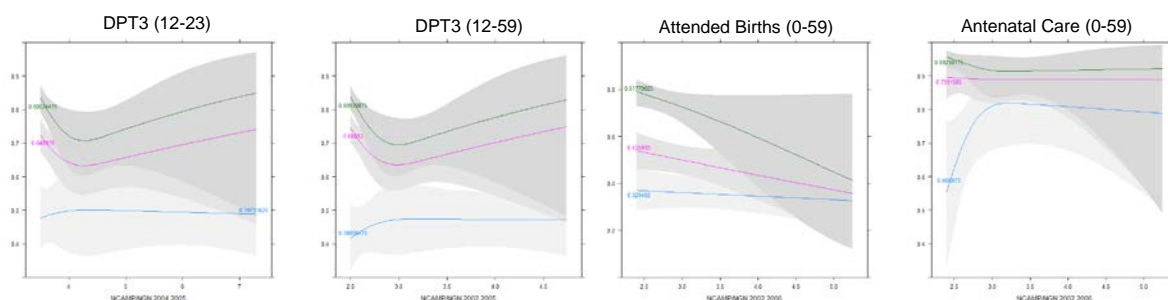


Figure 4. Effect of polio eradication campaign intensity on two measures of DTP3 coverage, attended birth coverage, and antenatal care cover in India.

Nepal. In the Nepal analysis, we examined the effects of polio eradication campaign intensity on measures of RI and maternal health care derived from Demographic and Health Surveys conducted in 2001, 2006, and 2011 for 13 regions (45–47). There was no variability in campaign maturity within Nepal because initial polio eradication campaigns were initially implemented as national immunization days. As a result, this analysis assessed the impact of polio eradication campaign intensity on two measures of DTP3 coverage (one for children ages 12-23 months and the other for children ages 12-59 months at the time of the survey), attended birth coverage, and antenatal care coverage (both for children ages 0-59 months at the time of the survey).

Figure 5 depicts the partial effects of polio eradication campaign intensity on each of the four measures of RI and maternal health care coverage. Grey bands indicate the 95 percent confidence intervals. These models do not include an interaction effect, so all additional covariates have been set to their median levels.

Polio eradication campaigns were correlated with more rapid improvement in DTP3 coverage up to about two campaigns per year as shown in the first two panels of Figure 5. At higher levels of polio eradication campaign intensity, there was no additional positive effect. The non-linearity of the effect was significant. In both cases, the coefficients were more significant and overall model performance was better when campaign intensity was added with a restricted cubic spline. However, these results were much more significant for DTP3 coverage in 12-23 month old children than for the broader measure of coverage in 12-59 month old children. This **inconsistency weakens our confidence in the result.** The difference could be due to less accurate maternal recall of DTP3

coverage for older children. But, we would have also expected the relationship to be consistent over time and exhibit a stronger signal when integrated over multi-year measures of polio eradication campaign intensity and DTP3 coverage.

In the analysis of attended birth coverage, the linear coefficient for campaign intensity was significant at the 98 percent confidence level and indicates that **higher levels of campaign intensity were correlated with increasing rates of attended births** as shown in Figure 5 (third panel). **However, the effect was small relative to the confidence intervals.** So the strongest statement we could draw from this analysis was that polio eradication campaigns (up to four per year) were not correlated with a reduction in the percentage of attended births.

The analysis for antenatal care did not find any evidence that polio eradication campaigns at the intensities seen in Nepal from 2001 through 2006 affected the rate of antenatal care. The partial effect of polio eradication campaign intensity on antenatal care was not statistically significant at the 90 percent confidence level and did not improve overall fit as measured by adjusted R^2 . The lack of statistically significant results may be due to a strong selection bias in which regions with higher initial rates of antenatal care coverage have more campaigns than those with lower initial rates of antenatal care coverage.

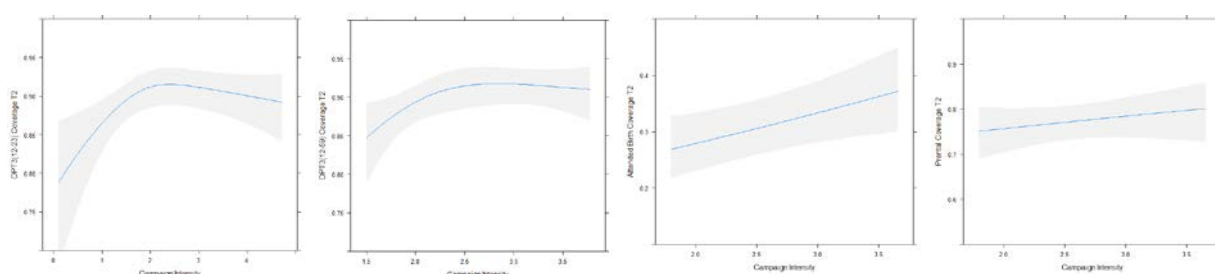


Figure 5. Partial effects of polio eradication campaign intensity on DTP3 (12-23), DTP3 (12-59), attended birth, and antenatal care cover in Nepal (from left to right).

Pakistan. The Pakistan analysis used two sources of data as variables: Pakistan Social and Living Standards Measurement (PSLM) Survey from the Pakistan Federal Bureau of Statistics (48) and Acute Flaccid Paralysis (AFP) data from non-polio cases from the World Health Organization (WHO) (49).

The PSLM surveys included data on the proportion of women receiving ante- and post-natal care at a public regional health center or basic health unit, the proportion of women delivering at a regional health center or basic health unit, the proportion of women receiving tetanus toxoid injection during pregnancy, the proportion of people who had health consultations at regional health centers or basic health units within two weeks of responding to the survey, and the proportion of children receiving three doses of DTP in the first year (DTP3). Surveys for three two-year periods were used: 2006-07, 2008-09, and 2010-11; three time periods were compared: 2006-07 with 2008-09, 2008-09 with 2010-11, and 2006-07 with 2010-11. In addition, the contextual variables of education (percent net enrollment at the primary level including katchi class), percentage of households using electricity for lighting, and percentage of households with a flush toilet were obtained from PSLM surveys. Each PSLM survey separated data into two sectors of the population (urban and rural), and total results were also reported. Included in the study were 93 districts in four provinces, but districts that were created or changed boundaries during the analysis period (2006-2011) were ignored, as were districts with zeros in any variables since some were obvious placeholders for missing data which would have affected the results.

The proportion of children receiving three routine doses of oral polio vaccine (OPV) in their first year was calculated from AFP data on individual non-polio AFP cases.

The combination of variables, time periods, and population sectors resulted in a total of 75 individual analyses. **Eighteen of the 75 analyses were statistically significant at the 90 percent confidence level** (over twice the expected number) and 12 of the 75 added explanatory power (as measured by adjusted R^2), but **no consistent patterns emerged by dependent variable, sector, start year, end year, or time span** (interval length).

These results suggest that there were no clear effects of campaign intensity on indicators related to RI, maternal health, or PHC outcomes. Significant test results did occur more often than would be expected at random, but the directions of the results were inconsistent and, therefore, not conclusive.

The lack of significant trends may be related to data quality (39). Although survey protocol is to interview the mother of the children directly, often the survey-takers allow anyone in the household to respond to the survey which can elevate the estimation of coverage; also, survey respondents are often allowed to rely on memory instead of verifying immunization records with vaccination cards which overestimates immunization history (40). On the other hand, vaccination cards are often incomplete records of vaccinations given and may underestimate vaccination coverage (40). Reporting protocol may not be standardized (or followed) and comparison of PSLM data with other sources (e.g., Demographic and Health Surveys, or DHS) suggest that the PSLM data may be inflated at the administrative level.

Nigeria. The Nigeria analysis examined the effects of polio eradication campaign intensity on two measures of DTP3 coverage (one for children ages 12-23 months and the other for children ages 12-59 months at the time of the survey), attended birth coverage, and antenatal care coverage (both for children ages 0-59 months at the time of the survey) derived from Demographic and Health Surveys conducted in 2003 and 2008 (50,51). The DHS survey for 2008 was conducted with sufficient sampling density to report RI, maternal health, and contextual indicators for 37 states. However, the sampling density for the 2003 survey was only sufficient to report such indicators for six regions and the sampling density for the 1999 survey was only sufficient to report results for five regions.² Therefore, we could not use the same methodology as we used for India and Nepal due to insufficient numbers of observations for regression. Fortunately, the 2003 and 2008 surveys report anonymized global positioning system (GPS) coordinates for each respondent. This enabled us to stratify the respondents by the number of polio eradication campaigns conducted in their district and supported examination of the univariate relationship between polio eradication campaign intensity and changes in RI and maternal health care; however, it did not support examination of multivariate relationships that controlled for contextual variables, because this would have subdivided the data more than could be supported with the available survey data. The interpretation of the Nigeria analysis was further complicated by the lingering effects of a polio vaccine boycott organized by political and religious leaders in the northern states of Kano, Zamfara, and Kaduna in 2003. This boycott “brought the immunization campaign to a halt by calling on parents not to allow their children to be immunized. These leaders argued that the vaccine could be contaminated with anti-fertility agents (estradiol hormone), HIV, and cancerous agents” (52).

We computed indicators for each of the dependent variables by district, well aware that low sample densities would create large confidence intervals. We then constructed cumulative distributions for each dependent variable over the districts in each of four campaign intensity zones (ranging from lowest intensity to highest intensity). These cumulative distributions were more robust to sparse sampling because the errors were equally likely in both directions (proportions that were either too high or too low).

The results for 2003 and 2008 are shown in Figure 6. In this figure, the x-axis is the proportion for the dependent variable (e.g., DTP3(12-23) coverage) and the y-axis is the proportion of districts with a dependent variable value less than or equal to the proportion on the x-axis. Red lines are for campaign intensity zone 1 (lowest intensity), green lines for campaign intensity zone 2, blue lines for campaign intensity zone 3, and magenta lines for campaign intensity zone 4 (highest intensity). The further the cumulative distribution is shifted to the left, the lower the overall performance of the indicator (a greater percentage of districts have a given value or less). The results for 2003 (left four panels) clearly demonstrate a strong selection bias for all four indicators. In each case, the magenta (highest campaign intensity) is significantly left-shifted relative to the red lines (lowest campaign intensity) indicating that regions with lower RI and maternal health care coverage received more campaigns than regions with comparatively high levels of coverage. For all four indicators, the difference between the cumulative distribution for the lowest intensity zone (Zone 1) is statistically distinct from the cumulative distribution for the highest campaign intensity zone at well over the 99.99 percent confidence level (Kolmogorov-Smirnoff p-value) (53).

² To further complicate time series analysis of the DHS surveys, the 6th region in the 2003 survey includes portions of multiple regions in the 1999 survey, making it difficult to assemble consistent geographies for all three surveys.

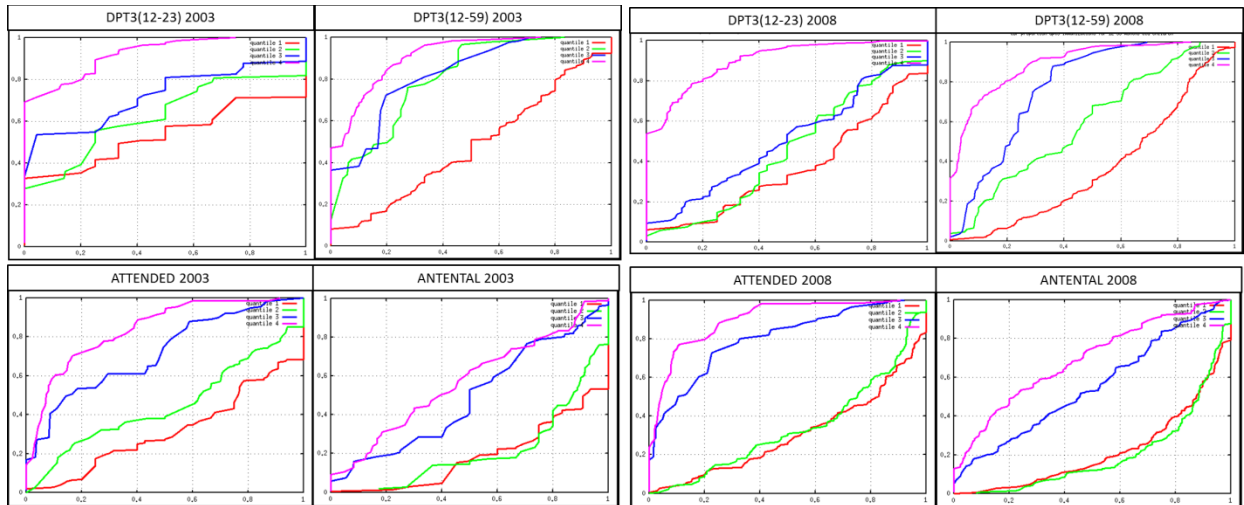


Figure 6. Cumulative distributions of RI and maternal health care indicators by campaign intensity zone in 2003 (left) and 2008 (right).

Figure 7 depicts the change in the cumulative distributions for DTP3 (12-23) and DTP3 (12-59) for each campaign intensity zone between 2003 and 2008. All four pairs for DTP3 (12-23) are statistically distinct from one another. The lines for 2008 (red lines) are generally right-shifted relative to 2003 (blue lines). This indicates a general trend toward improvement in DTP3 (12-23) coverage between 2003 and 2008. However, the shift is much smaller for the highest campaign intensity zone (Zone 4) than for lower campaign intensities. This suggests that **the rate of improvement is smaller in regions with relatively high levels of polio eradication campaigns. However, these are also the regions with lowest initial DTP (12-23) coverage. Other factors that co-occur with poor initial DTP3 coverage (e.g., political instability, poverty rates) are likely driving this result more than polio eradication campaign intensity by itself.**

The results for DTP3 (12-59) and antenatal care coverage are similar, but with only three and two statistically significant pairs, respectively. The results for attended birth coverage were not significant at the 90 percent confidence level.

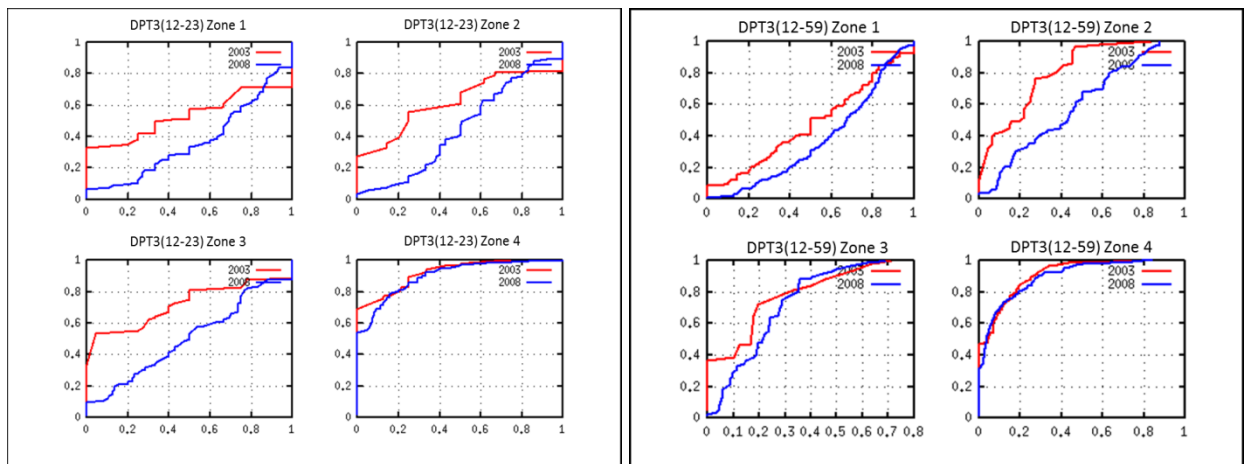


Figure 7. Changes in DTP3 (12-23) and DTP3 (12-59) coverage between 2003 and 2008 by campaign intensity zone.

3.5 Conclusions

In sum, though there were many statistically significant effects in our analyses, most were very small relative to confidence intervals, and none could be conclusively attributed to polio eradication activities.

Therefore, neither claims that polio eradication activities have been a boon to RI and PHC, nor claims that they have been disastrous for RI and PHC, find strong support in our quantitative analysis.

It is worth highlighting that the most intense polio campaigns tend to occur in the areas with low levels of RI coverage and coverage of maternal health indicators (Figure 8).

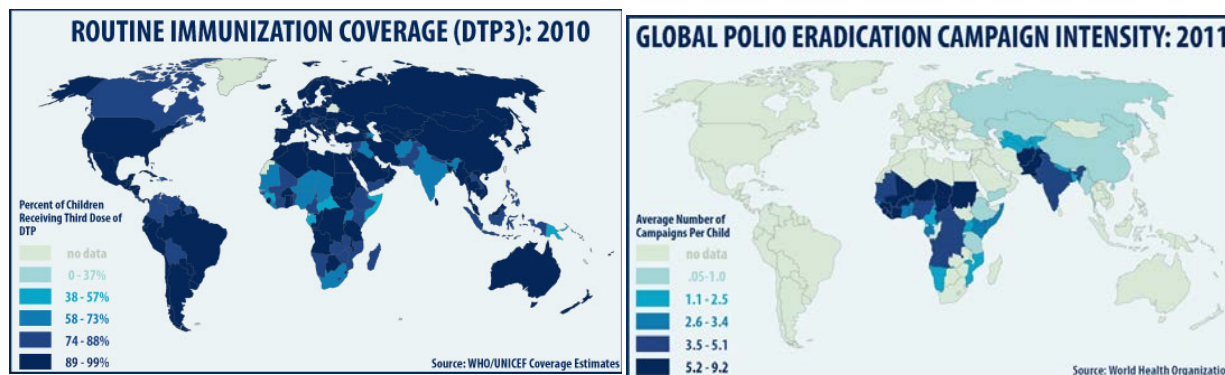


Figure 8. National RI coverage in 2010 (sources: WHO/UNICEF) compared to the number of polio campaigns in 2011 (data source: WHO).

There are of course some exceptions to this—like within Nepal, where geographic factors complicate the picture. Overall, however, not surprisingly, polio campaigns tend to occur most in areas with poor health services.

We discuss below the missed opportunities in polio’s involvement in these areas. As polio’s most intense involvement occurs in places with the greatest need for improved health services, **seizing these missed opportunities in areas where polio eradication activities are most intense would mean improving RI and PHC in the places that need it the most.**

4. RESULTS: QUALITATIVE

Here, we summarize our qualitative findings in the following areas:

- Disease surveillance
- Outreach to marginalized or remote populations
- Financing
- Cold chain
- Training, supervision, and monitoring
- Worker motivation
- High-level attention
- Public awareness
- Worker time allocation
- Service interruption

For each subject area, we first describe how the current system is designed to operate under the polio eradication program. We then describe how each of these domains operated in our case study locations and how RI and PHC activities were positively and/or negatively impacted, while highlighting missed opportunities and the barriers to seizing these opportunities. Finally, we provide key recommendations for how polio eradication efforts can be leveraged to strengthen RI and PHC.

In addition to summarizing our findings across case studies, we have captured several exemplary practices or noteworthy results from each of our case studies. The In Focus boxes that correspond to each subsection of the qualitative results describe these inspiring stories in detail.

4.1 Disease Surveillance

The Global AFP Surveillance System. Globally, GPEI headquarters (within the WHO office in Geneva) is responsible for polio surveillance and, and therefore monitors indicators and collects surveillance data on acute flaccid paralysis, or AFP, from around the world. Overall, looking across the case studies, the polio surveillance system combines global reach and active surveillance quality in a way unmatched by any other system in the world—and perhaps any surveillance system in history.

AFP Surveillance Systems in Our Case Studies. Though the exact mechanisms differed, the AFP surveillance systems in all of our case studies, save Rwanda³, were largely managed by WHO staff at the national level, and have historically had AFP surveillance as their sole or primary focus. Each of our case study countries also had one or more government surveillance systems: these systems range in quality from excellent for select diseases, to completely defunct.

All of our case studies were served by WHO surveillance staff in or near the study district—and in all cases AFP surveillance was considered a primary role, or the sole role, of these staff. In all cases, these district-level officers officially worked with government counterparts, and in all cases they relied on government health facilities to report cases. A national-level official in Ethiopia explained their system:

In fact the responsible person for polio surveillance is WHO—it assigns its own people in every zone. These [WHO] surveillance officers work together with the health centers [and] with the health extension workers [in the] health posts. Usually they give training about the polio surveillance system.... And these [WHO surveillance officers] are regularly going to check whether these people are working on the surveillance system. This is starting from the low level: health extension workers are trained for this purpose. And even the health center level has those concerned people: an EPI [Expanded Programme on Immunization] focal person is trained for this surveillance system. And it goes up to the woreda and zone and so on.

Still, the extent of government contribution to the surveillance system varied. In the end, respondents in all Asian and some African case studies identified AFP surveillance as ultimately a WHO program.

The AFP surveillance systems in our case studies were characterized by the following: high quality; active surveillance visits; extensive additional staff; and lab facility support (often constructed by GPEI). Taken as a whole, the system was unmatched and probably unprecedented.

Positive Impacts on Routine Immunization. The first and most significant positive impact of the AFP surveillance system on RI was the **inclusion of other vaccine preventable diseases (VPDs) that otherwise might not have such high quality surveillance**. Other VPDs were not included in the AFP surveillance system in all case studies, but in many case studies, including Rwanda, India, Angola, Nepal, and Ethiopia, the AFP system provided a base for additional surveillance activities. However, despite some system overlap, many of the surveillance protocols for AFP and other VPDs remained separate. For example, systems often used different monitoring and reporting personnel, protocols, and procedures to track suspected cases of various diseases. The lack of integration often lead to duplicated efforts The Surveillance In Focus box provides additional information on the Nepali system—the most integrated AFP-based system of any of our case studies.

The second positive impact of AFP surveillance on RI was the **involvement of WHO-funded surveillance staff in some RI activities**. In many countries, including Nepal, Nigeria, and India, their official job description included some RI involvement. While in practice most surveillance medical officers were observed focusing on polio in our case studies, we did observe surveillance medical officers' contributions to RI in Nizamabad, Andhra Pradesh.

In Pakistan, **data on non-polio AFP cases** included how many *routine* doses of OPV the child has received. **This provided an important alternate measure of RI coverage in a place where administrative coverage statistics are often unreliable**. Pakistan is one of the only countries in our study that collected this information for non-polio

³ Rwanda was unusual among our case studies in that AFP surveillance was mainly a passive add-on to an existing functional surveillance system.

AFP cases; it is fairly easy to collect, and both expanding this practice to more WHO regions, and making the data more widely available, could have substantial positive effects for RI.

Negative Impacts on Routine Immunization. In the early years of the AFP surveillance program, **WHO hired qualified government staff in at least some of the case study countries.** While these staff often benefited from more logistic and other support from WHO, their absence likely weakened already overstretched government programs in some cases.

Impacts on Primary Health Care. **No effects—either positive or negative—on PHC were observed or reported** as a result AFP surveillance. In other words, the established AFP surveillance systems did not directly contribute to the surveillance of non-vaccine-preventable diseases (e.g., malaria, cholera, kala-azar) in any of our case studies.

Missed Opportunities. It is a missed opportunity to make active visits to care providers (in the most remote corners of the world), incorporate this data into an extensive, high-quality surveillance system, and then use this system to collect information on only one disease (or at best a handful). Given that this activity takes a substantial amount of WHO and government staff time, adding surveillance of additional diseases to the system seems a natural step.

The AFP system is primarily health facility based in most of our case studies, and thus it is not an ideal surveillance system for all diseases—it would miss many cases of neonatal tetanus, for example. However, some of our case studies had a community-based component to their AFP surveillance system; community-based surveillance was especially developed in Angola. Even in the absence of community-based surveillance, good sentinel site surveillance could provide useful information on disease trends.

Barriers to Seizing Surveillance Opportunities. Some of the barriers to expanding the AFP surveillance system are discussed in the Surveillance In Focus box. In addition, interviewees at the national level in several countries noted that they were reluctant to rely too much on the AFP surveillance system because it was seen as inherently unsustainable. Given that the AFP surveillance system in most of our case studies was supported nearly entirely by external funding, respondents expressed concern that once polio was eradicated, the system would disappear. An interviewee at the national level in Pakistan elaborated:

There has been a surveillance system in the government that has not been used for polio activities. What was done was, a parallel system was created for polio surveillance, and that's run by WHO. So the good thing is, there is now a good surveillance system for polio. The bad thing is, it is run by WHO and so it's not sustainable. Tomorrow if the WHO leaves there is nothing left. And that poor government surveillance system was neglected since WHO took over this part. It was limping before; now it's almost crawling.

Respondents in other countries felt it was risky to extend surveillance efforts to other diseases if the expanded system was to be built on AFP, a system that might deteriorate in the absence of foreign investment.

Recommendations for Surveillance. Key to consolidating a positive impact of AFP surveillance on the health system, then, is of course to **include surveillance for other health issues**, but more fundamentally to **create a country-specific legacy plan** that will answer questions about the sustainability of the AFP system. Such a plan should address the following questions:

1. What will be done with the surveillance infrastructure (including its associated labs) post-GPEI?
2. How can it be ensured that trained staff continue to receive logistic and financial support for high-quality work?
3. How will these staff best support surveillance for other diseases in the long term?
4. Can this process begin now? What is the timeline for it happening?

Ideally, of course, ownership of these surveillance systems should be transitioned to the governments in question—and the issues of maintaining funding and support for qualified staff and lab facilities should be given careful attention in such a plan.

Clarity on these questions would make integrating more diseases into the existing strong AFP infrastructure easier. Without a plan, holes could be left in the system if polio surveillance staff have been assisting elsewhere; and a

highly organized, highly trained surveillance operation that could be a boon to surveillance globally could be lost. With a global plan that gives attention to specific country needs, the AFP surveillance system could transition into the highest quality integrated surveillance system the world has known.



In Focus: SURVEILLANCE

Integrated Disease Surveillance in Nepal

After starting polio national immunization days in 1996, WHO Nepal designed and launched an AFP surveillance system coordinated by the Immunization Preventable Disease office in Kathmandu. This system currently includes a network of 11 field surveillance offices staffed by at least one of 15 surveillance medical officers. These officers conduct weekly visits to 89 active surveillance sites and receive weekly reports from 521 zero reporting sites. They coordinate with government staff to visit the active surveillance sites, and rely on government health providers to contact them if an AFP case is found.

In 2003 and 2004, the government decided to integrate measles, neonatal tetanus, and Japanese encephalitis surveillance into the WHO-run program; this move was heralded by the government and WHO as very successful. The integration of vaccine-preventable disease surveillance with AFP surveillance has been an important positive impact of the Nepali polio eradication program on RI. Also, it was the **most integrated AFP surveillance system found in any of our case studies** and the only one with an integrated reporting form.

The now integrated WHO system was largely considered the most advanced and sophisticated surveillance system in the country. It should be noted that there are at least two other systems that report disease occurrence. The first, the Health Management Information Service, reports aggregate data on an annual basis for statistical purposes; the second, the Early Warning and Response System, is functional in only 40 sites and is limited to six diseases or syndromic conditions.

Overall, satisfaction with the WHO surveillance system was generally high at all levels of the health care system—one national official described it as “the only surveillance working”—and integration of vaccine-preventable disease surveillance was seen as successful. The 2006 Joint Annual Review of the surveillance system found that integration had improved surveillance of the three vaccine-preventable diseases now included in the WHO system and that the extra responsibilities had not affected the quality of the surveillance medical officers’ work. An unaffiliated immunization expert was impressed with the WHO system and posited that cooperation between the government and nongovernmental organizations contributed to its success. “...this [WHO surveillance] is within the government and supported externally. That’s why it’s working efficiently. They have the resources, they have the people.”

In Rautahat, too, staff mentioned only the integrated WHO system when asked about surveillance, and seemed satisfied with the system. Government staff at the district and sub-district level indicated that they participate in WHO surveillance, and were able to correctly describe their roles in the surveillance system.

The integration of the other vaccine preventable diseases into the AFP surveillance system appeared to be considered a success at all levels of the health system: front-line health workers generally knew how to report suspected cases of these diseases, district level officers felt that surveillance was conducted adequately, and central-level officials believed that the WHO system was effective and efficient.



Nepal's integrated surveillance system detects cases of AFP and other diseases

The apparent success of the integrated WHO surveillance system raises the question, **why is such a successful system only used to monitor four diseases?** Respondents to the interviews identified a heavy workload and limited resources as part of the answer. The government Child Health Division responsible for immunization has found its purview expanding substantially over the last few years, as new vaccines mean that an increasing number of diseases are classified as vaccine preventable.

None of the district-level employees who were interviewed complained about the extra responsibilities they had to take on, but many higher-level officials maintained that the WHO system does not have the resources available to support much more expansion. It would be beneficial to further expand the system to cover other diseases like malaria and kala-azar, but without increased resources, especially workforce at the district level, our interviewees suggested that the WHO system does not have the capacity.

In addition to limited resources and workforce, the data suggested that **the Nepal government**, whether because of limited commitment or ongoing political instability, **had not yet assumed ownership of the WHO surveillance system**. Despite the fact that many of the government and UN officials who were interviewed stated that the Ministry of Health and Population wished to take control of the surveillance system, the handover had not occurred. One official explained that the government has more pressing priorities than disease surveillance. “The government is not stable. We don’t have a strong Ministry [of Health and Population]. We are restructuring the whole country, and the government is focused on those kinds of things.... [Therefore, WHO] will have to continue it [surveillance].”

From this official’s perspective, the government was dealing with many issues, and was not yet in a position to take over disease surveillance. Unfortunately, as another official explained, this means that **the sustainability of the surveillance system is at risk**. “There is a good chance when polio funds stop, the surveillance system won’t go on any longer. We try to encourage the government to develop a transition plan....”

In Nepal, improved surveillance for neonatal tetanus, measles, and Japanese Encephalitis have been built squarely upon polio surveillance—a clear example of people seizing an opportunity for polio systems to create health system benefits. But, because funding for the AFP surveillance system is unlikely to exist indefinitely, and because the government has not yet taken responsibility for this system, its purview is limited and its sustainability is at risk. This example underscores the need for international institutional support for consolidating and expanding the AFP surveillance system to provide solid, long-term health system gains—and for continued collaboration with governments to ultimately transition these systems into capable local hands.

VACCINE PREVENTABLE DISEASE SURVEILLANCE SYSTEM

WEEKLY REPORTING FORM

*After review of all wards and registry books,
please complete and send this report to the following office every Monday.*

Office Location of Surveillance Medical Officer (SMO): WHO-IPD, C/O DHO Makwanpur, Rapti Road, Hetauda

Telephone: 057-524671

Fax: 057-524672

Email: IPDBig@searo.who.int

Name of health institution: _____

Region: _____

District: _____

Week No. Period included in this report: From ____/____/____ to ____/____/____

Number of cases identified during the week. If no cases were identified, write 0 (zero):

AFP

NT

Suspected Measles

AES

Please list each AFP, NT and Acute Encephalitis Syndrome (AES) case identified during this time period:

Diagnosis (circle one)	Name	Age/ Sex	Father's Name	Address
AFP NT AES				
AFP NT AES				
AFP NT AES				
AFP NT AES				
AFP NT AES				

Please fill out the information below for any Suspected Measles patient seen in the facility or admitted during the last week:

Date of visit or admission	Patient Name	Sex	Age	Full Address (Dist/VDC/Ward)	Ever had MSL vacc? (Y/N/U)	Hospitalized? Y/N/U	Died? Y/N/U

Please fill the information below:

No. of Pneumonia (any age)		No. of Pneumonia cases with avian influenza (bird flu) exposure history		Sudden Death of Domestic Birds	Sudden Death of Wild Birds
Cases	Deaths	Cases	Deaths	Y/N/U (if yes, how many)	Y/N/U (if yes, how many)

Name of person filling this report: _____

Date of report sent to Surveillance Medical Officer: _____

Signature of Head of the Institution: _____

All cases of AFP in children <15 yrs., and all Neonatal Tetanus cases should be reported IMMEDIATELY to SMO!
All Health Institution should report weekly even if NO case of AFP NT measles and AES were identified.

4.2 Outreach to Marginalized Populations

Polio Eradication's Outreach to Marginalized Populations. As eradication is the goal, polio vaccine must reach children in every corner of the world, especially children that remain uncovered by RI programs where they live. Often, such children belong to socially marginalized groups. The nature of these groups varies from place to place; but across countries, polio eradication staff has engaged in extensive identification and mapping of migrants, slum dwellers, and other populations that have remained largely beyond the reach of local health systems.

Outreach to Marginalized Populations in Our Case Studies. In most of our case studies, polio eradication workers expended extensive energy finding, mapping, and repeatedly visiting populations that were previously unreached by RI or other health services.

The extent to which outreach to socially marginalized populations existed for other health services as well varied widely across the case studies. In some cases, such as Nizamabad, India, there were a number of programs aimed at reaching the entire population with services (see Outreach to Marginalized Populations In Focus). In contrast, polio eradication was credited with having “discovered” some nomadic populations in Northern Nigeria (outside of the case study district)—indicating that not only was the health system not providing services in these populations, it was apparently unaware of their existence (54).

Positive Impacts on Routine Immunization. Several isolated, context-specific positive impacts were observed in our case studies. In Pakistan, camps to extend RI to marginalized populations have been proposed in the polio emergency action plan—though to our knowledge these camps had not yet been put into effect at the time of our research. Also, in Nizamabad, India, information on marginalized populations’ RI status was collected during polio activities (see Outreach to Marginalized Populations In Focus).

In addition, special efforts were made (or in the processing of being made) in several case studies to target at-risk and/or remote populations with RI messages along with polio services during campaign activities.

Negative Impacts on Routine Immunization. Generally, identifying and reaching marginalized populations had no negative effects across our case studies. One minor exception was in Rautahat, Nepal, where some higher-caste community members avoided both polio campaign booths and RI outreach sessions if they were placed near Dalits (castes deemed as untouchable) and other marginalized groups or communities.

Positive Impacts on Primary Health Care. There are **potential** positive impacts on PHC as a result of polio’s outreach across our case studies, in that **health staff may become more aware of marginalized populations than previously**. This was specifically mentioned by interviewees in Kumbotso, Nigeria; SITE Town, Pakistan; Rautahat, Nepal; Camucuio, Angola; and South Omo, Ethiopia; but it is a phenomenon that likely occurred across our case studies. Hopefully, staff improve their outreach to these populations based on this knowledge—but we did not obtain any direct evidence of this happening.

There were isolated instances of more direct positive impacts on PHC from polio’s outreach to marginalized populations. A particularly far-reaching and well-planned example is India’s 107 Block Plan (see Social Mobilization In Focus).

Also, in Kumbotso, Nigeria, **polio campaigns that include other health services** provided direct benefits to marginalized populations during campaigns. Nigeria’s “Immunization Plus Days” not only administered OPV but also provided vitamin A, soap, milk, clothing for infants, and sweets to everyone, including marginalized populations. While the health value of sweets may be questionable, overall this represents a simple, direct, and effective way of providing additional interventions to the entire population—including those who need them most.

Similarly, integrated campaigns were implemented in Rubavu, Rwanda and Camucuio, Angola. According to interviewees in Rubavu, these campaigns provided another opportunity for community health workers to assess the health of remote populations and administer services when necessary. One respondent stated:

[During polio campaigns, remote populations] are also vaccinated and when we go there we assess other problems as well, we advise and support them, and we go back again to see if there is any change

happening in their living conditions. We teach them about good nutrition, living in houses, and using mosquito nets to prevent, hygiene (body, beds, utensils), drinking safe water. All these things are spread everywhere since this polio vaccination program was introduced.

Negative Impacts on Primary Health Care. No negative impacts on PHC were reported in any of our case studies as a result of polio eradication's outreach efforts.

Missed Opportunities to Reach Marginalized Populations. Taken as a whole, the maps and information collected by polio eradication programs in various parts of the world represent a likely unprecedented collection of information on the most marginalized populations. But both at local and international levels, **this information was only rarely used to assist in the provision of anything beyond polio vaccine.**

The State of the World's Vaccines and Immunizations in 2009 described a situation where many children remain unimmunized because they are in populations that, for one reason or another, are marginalized, without easy access to health facilities (55). The report also noted that more research is needed—that information on who and where these populations are is spotty.

The GPEI actually has the power to address this issue on a global scale. (It already has addressed this issue for polio vaccination.) But this power is thus far unharnessed.

Barriers to Seizing Opportunities. The barriers to seizing opportunities to use polio's health information in provision of other services are not particularly serious. Commitment to this issue is required, as is collaboration and coordination with people providing other health services.

Recommendations. There are a number of **immediate steps** that could be taken to create an impact on outreach to marginalized populations.

- Integrated campaigns, like Nigeria's Immunization Plus Days (IPDs), will reach marginalized populations with more interventions.
- Interviewees in Rautahat, Nepal suggested that 'volunteer' community health workers assigned to polio campaigns should be provided with additional days of pay to follow up on outreach to marginalized populations—a suggestion that strikes us as a good idea in other case studies as well.
- On a global scale, the maps of marginalized populations generated by the polio eradication programs should be collected and standardized. A global information system on marginalized populations could be constructed. In conversation with other partners like GAVI, the potential of these maps could be fully utilized—leading to the provision of additional services to these populations.
- The power of technology to assist in such mapping should be utilized—a process already started in the use of geographic information system (GIS) technology to map populations in Nigeria.

Long-term, creating **country-specific polio legacy plans** should ensure that the work that has gone into reaching marginalized populations is not lost. These plans should address the following questions:

1. What will be done with the information on, and maps of, marginalized populations post-GPEI?
2. How can it be ensured that critical health services like RI are more effectively delivered to these populations?
3. Can this be made sustainable in the long term? How?
4. Can this process start now?



In Focus:

OUTREACH TO MARGINALIZED POPULATIONS

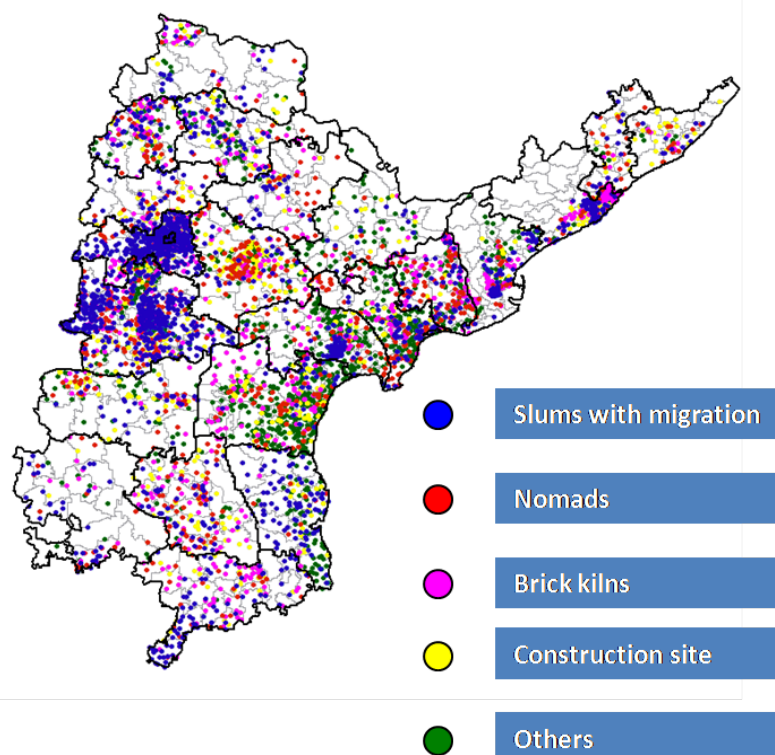
Assessing RI Coverage in Migratory Populations in Nizamabad, Andhra Pradesh, India

Andhra Pradesh's **polio program has a highly organized and targeted approach to reaching marginalized populations during campaigns**. As of 2006, populations identified for focus included urban slums not recognized by authorities; nomadic tribes; "boat people"; families farming isolated areas like river islands; children living at construction sites and brick kilns; and people of low socioeconomic status, among others. Workers are to take "special measures," including intensified social mobilization, supervision, and monitoring, as well as tactics such as coordinating with brick kiln owners, to ensure that these populations are covered during campaigns.

In our research, we observed this focus in practice in the February 2012 campaign. In Nizamabad, these populations were described, discussed, and emphasized throughout planning and pre-campaign meetings and trainings. The number of households—and children under five—in slums with migration, nomadic settlements, construction sites, and communities of fishermen were enumerated and mapped (the graphic here was generated by the polio program). And beyond simply identifying the populations, any constraints or barriers to reaching them were to be addressed as part of the planning process. Official policy is to visit brick kilns and construction sites twice during the campaigns. Coverage of migrant populations was even monitored separately to ensure high quality.

More generally, there has been a long standing interest in Andhra Pradesh of the needs of socially marginalized populations, as evidenced by the emergence of Integrated Tribal Development

Marginalized Populations in Andhra Pradesh



Agencies during the fifth five year-plan (1974-79), and more recently, in the inclusion of specific strategies for vulnerable groups within the National Rural Health Mission. Through the National Rural Health Mission, **several initiatives target marginalized populations for provision of PHC services**. Mobile vans have been deployed. In addition, front line workers said they made an effort to provide maternal and child health services to people in temporary settlements. These groups are identified during field trips and biannual household surveys. However, **since there is no separate reporting column for capturing data on having delivered services to these groups, the outcomes of the efforts cannot be ascertained**. The only exceptions are the National Leprosy Eradication Program and the data on sterilizations, which are analyzed annually, by caste and religion, at the district level.

For **routine immunization**, while respondents identified outreach to marginalized populations as important, **monitoring whether they were reached was difficult until recently**. Because RI coverage in Andhra Pradesh is evaluated in terms of number of children covered—not on detailed information on who those children are—as of

2011, sophisticated information on potential pockets of children not reached by routine immunization was not available.

A recent addition to the polio program may change this situation. As part of a new addition to the polio process, **workers visiting migratory populations as part of the planning process now note whether an RI mobilizer has visited the site, and whether the child in question has received RI and has an RI card.** This step has the potential to generate detailed new information about RI coverage in marginalized populations. A state-level official described this initiative as a plan to “reach each and every child.... For routine immunization and pulse polio, both.”

While the effectiveness of this new program has yet to be proven, and it currently has weaknesses—many of the forms in the February campaign were not fully filled out with RI information--it represents in our opinion a low-labor, potentially high-impact add-on to polio eradication activities. It could potentially be expanded to assess coverage of other key health services in these and other traditionally underserved populations.

Field Validation of Sites with Migratory populations

Name of District: Nizamabad

Name of the person conducting Field Validation: PRK-SALOORA

Date: 01.02.2012

Designation: Polio Vaccinator / Polio Supervisor / Field Volunteer / External Monitor / Others

Sl. No.	Block Name	Planning Unit Name	Type of Site *	Name of the Site & Location	Date Field Validation Done	Estimated Population	Estimated Households	Estimated Beneficiaries (0-5 years)	Where are they Migrated from?	Site include d in SIA micropl ans? YES / NO	Site include d in RI micropl ans? YES / NO	Any RI Moblizer (HVI/ASHA) visiting the site?	Child 1		Child 2		
													0-2 yr receivin g RI doses	0-2 yr has RI card	In case of illness where do they go for treatment?*	0-2 yr receivin g RI doses	0-2 yr has RI card
A	B	C	D	E	G	H	I	J	K	L	M	N	O1	O2	P1	P2	
1	SALOORA	Saloora	5	Tirumala Rice mill Nagar	1-2-12	25	10	9		Y	Y	Y	Y	Y	PHC	Y/N	Y/N
2	V	Humsa	1	Humsa	1-2-12	42	19	9		Y	Y	Y	N	N	PHC	Y/N	Y/N
3	V	V	1	Mandanna	1-2-12	26	14	12		Y	Y	Y	N	N	PHC	Y/N	Y/N
4	V	V	1	Khejraoor	1-2-12	34	11	10		Y	Y	Y	N	N	PHC	Y/N	Y/N
5	V	Kummanpally	1	Kummanpally	1-2-12	20	7	6		Y	Y	Y	N	N	PHC	Y/N	Y/N
6	V	Perikurula	5	Perikurula	1-2-12	20	7	7		Y	Y	Y	N	N	PHC	Y/N	Y/N
7	V	V	-d-	Perikurula	1-2-12	34	13	16		Y	Y	Y	N	N	PHC	Y/N	Y/N
8	V	V	-d-	Chetki	1-2-12	31	16	15		Y	Y	Y	N	N	PHC	Y/N	Y/N
9	V	V	-d-	Srinivas	1-2-12	22	8	7		Y	Y	Y	N	N	PHC	Y/N	Y/N
10	V	Kalidindi	3	Neer Bridge	1-2-12	23	12	11		Y	Y	Y	N	N	PHC	Y/N	Y/N

Notes: Type of the Site is categorized as 1- Slums with migration, 2- Nomads, 3- Brick Kilns, 4- Construction site, 5- All other category other than the first four (please mention the name in case of Others)

1- Bhat Health facility 2- Private Practitioner / Traditional Practitioner / Others by name & location

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Note: Type of the Site is categorized as 1- Slums with migration, 2- Nomads, 3- Brick Kilns, 4- Construction site, 5- All other category other than the first four (please mention the name in case of Others)

1- DSI Health facility? Private Practitioner / Traditional Practitioner / Others by name & location

Please use back side of this form for writing additional information

Medical Officer
PRIMARY HEALTH CENTRE
SALOORA

4.3 Financing

Financing Polio Eradication. **Polio eradication is largely internationally funded.** The largest donors in cumulative terms since 1984 are the governments of the United States and the United Kingdom, the Bill & Melinda Gates Foundation, Rotary International, and the World Bank (56).

In many of our case study countries, polio eradication funding was entirely external. That said, governments made substantial indirect contributions in areas like staff time. **The notable exceptions to this were India, Angola, and Nigeria.** India's direct financial contributions to polio eradication top \$1 billion USD since 2003; Angola has contributed about \$24 million USD since 2007; and Nigeria has recently increased its yearly commitment from \$13 million USD to \$30 million USD for 2012 and 2013 (56,57).

Polio Eradication and Other Funding in Our Case Studies. From inside the polio eradication program, funding shortages seem acute—and indeed, campaigns have had to be scaled back in recent years due to financial shortfalls (58). Still, when viewed from on the ground in our case study districts, **in comparison to other health services, polio was well funded overall.** As the photos here illustrate, physical infrastructure at local health centers in many of our case studies was inadequate or crumbling. The shortages of materials, non-availability of funds for staff, and insufficient infrastructure that plague PHC services in many of our case studies are not so apparent in polio



Photo. Structural damage at health facility in SITE Town, Pakistan.



Photo. Delivery room in in Purba Champaran Bihar India

eradication. Insufficient funding was not the only culprit in under-resourced PHC services—corruption and the inability to absorb funds were also contributors in some case studies—but nevertheless, interviewees across our case studies consistently described polio campaigns as exceptionally well resourced.

Comparing domestic polio and other funding directly was possible in the case of India, which contributed so much of

its own funds for polio eradication. **India's polio budget is more than twice its overall RI budget year after year.** Of course, this high funding level was part of what facilitated the elimination of polio from India: but the extent of expenditure focused on one disease was striking.

The question of whether international funding for polio would have been given to other health initiatives in the absence of the GPEI is an ultimately unanswerable question. Major donors like the United States government, Rotary, and the Bill & Melinda Gates Foundation *might* have given some of that funding to other health programs, but it is likely that a substantial portion of the funding is specific to polio eradication enthusiasm.

Positive Impacts on Routine Immunization. In nearly all of our case studies, polio funding was used regularly for cold chain maintenance (see section on cold chain).

In addition, in several case studies, polio funding has been used quite directly to benefit RI services. In Rwanda, polio funding was integrated with RI funding and was said to assist in the rollout of new vaccines. In Ethiopia, polio funds were used to assist in funding other health services in the mid-2000s (see Funding In Focus). **In the other case studies, we found little or no evidence that polio funding has directly benefited RI services.**

Negative Impacts on Routine Immunization. No direct negative impacts on RI from polio funding were observed. For a discussion of how polio funds in India and Angola might have been used for other health system goals, see “Negative Impacts on Primary Health Care,” below.

Positive Impacts on Primary Health Care. No major positive impacts on PHC as a result of polio eradication funding were noted in our case studies.

Polio funding for integrated campaigns provided modest, time-limited support for PHC services, narrowly defined, in a few case studies. In Rubavu, Rwanda, polio and PHC funds were merged to provide integrated services during campaigns. Similarly, polio funding provided support for other health services, like soap and vitamin A supplements, that were distributed during Nigeria's Immunization Plus Days.

Negative Impacts on Primary Health Care. **India spends a great deal of money on polio eradication that could potentially be used elsewhere:** \$250 million USD was spent on polio eradication in 2011 alone (56). Were polio eradication not to exist, this funding would potentially be available for other health services. However, this relationship may be less straightforward than it appears at first, given difficulties in absorbing funds across much of India. Funding for the National Rural Health Mission in Bihar, for example, remains consistently underutilized (59).

In Angola, external funding provided some support for polio materials and equipment, while the Government more than 80 percent of polio campaigns' overall costs, including polio workers' incentives and transportation, as well as community-level social mobilization efforts. Funds for these latter efforts were extracted from a pool of integrated funds provided by the Government to each municipal to support local PHC activities, including RI and campaigns. It is worth noting that RI outreach to remote and mobile populations had to be scaled back in Angola in 2008 and 2009 due to a shortage of funds (60,61).

Missed Financial Opportunities. Given the natural alliance between strong RI coverage and the goal of stopping polio transmission, willingness by the GPEI to allow funds to be used to directly support RI services in specific contexts might be fruitful, both for struggling RI programs and for the eradication of polio.

Barriers to Seizing Financial Opportunities. Some (though not all) senior leadership in polio eradication may view RI initiatives not as natural allies but as competitors for limited resources. A revealing example of this perspective came at the Polio Technical Consultative Group meeting in May 2000, where the then-fledgling GAVI was discussed. Notes taken at that meeting and provided to the study show that while some participants warmly embraced GAVI as a natural partner, others viewed the new initiative as a competitor and a threat. The document released by the group reflects some of those anxieties:

GAVI represents a good opportunity to strengthen immunization programmes and enhance efforts to eradicate poliomyelitis. However, a number of major polio partners have expressed concern that this opportunity has not yet translated into direct support for country level implementation of polio eradication strategies. Furthermore, the demands on polio-funded immunization staff, particularly at the regional and inter-country level, to assist in GAVI-related activities, such as the preparation of applications for funds from the Global Fund for Children's Vaccines, has markedly increased. This has decreased the time available for polio-funded staff to work on polio eradication. (62)

At times, then, some senior polio eradication leadership have seen RI activities as not only outside their mandate but as potentially destructive to the goal of eradicating polio.

Recommendations for Financing. **Greater attention to funding RI in places where coverage is low may also help the goal of polio eradication.** There is evidence that attention is currently being given to this issue—recent Independent Monitoring Board and India Expert Advisory Group documents, for example, underline the importance of supporting RI coverage (63,64). One aspect of true support for RI may be direct funding support.

Post-polio plans should include funding as an integral component. Ensuring the legacy of polio, while certainly worthwhile and likely an excellent value, will not be free.



In Focus: FINANCING

Ethiopia in the Early 2000s

A 2002 report jointly issued by the World Bank and the Government of Ethiopia offers valuable insight into national immunization program costing and financing roughly a decade ago. The following is pulled from that report:

There is a lack of interest by donors to fund EPI [Expanded Program on Immunization], as compared to campaigns, which have a high political visibility.... The lack of budget for operational costs (primarily transport and per diems for outreach) is consistently cited as one of the major barriers to improved coverage. In principle, funding of these costs is the responsibility of local government. In practice, this means there is often no budget at all.

Very few donors are active in the routine EPI program, in contrast to the PEI [Polio Eradication Initiative], which is a high priority on the global agenda and consequently receives more funding.

As mentioned above, the routine immunization program struggles with serious resource constraints. The requested budget according to the Action Plan 2001 amounted to USD 6.9 million, excluding salaries. Even if this budget is partly over-estimated, it still means a funding gap for the EPI program of about USD 4 million. A proportion of this gap was filled by support made available through the PEI, where donors have allowed some flexibility with funding. For example, allocation of equipment to EPI outside the period of campaigns and utilization of campaign funding for activities that will benefit routine EPI simultaneously (cold chain and transport equipment, surveillance, training and social mobilization) has taken place.

In Ethiopia expenditure patterns of polio funding suggest it has been used, as much as possible (given donor conditions), to strengthen the routine program. For example, the cold chain and transport infrastructure and disease surveillance have all received much needed financial support. Whilst there is a reasonable expectation a level of external polio funding will continue to flow (at least until 2005 when Ethiopia is planning to be polio free), it is likely that a) funds will be increasingly difficult to secure and b) the level of funds required and therefore provided will decrease dramatically when the strategy shifts into SNIDS [subnational immunization days] and mopping up phase in 2003. As a result, any reliance on polio funding for continued subsidization of the routine program is risky.

This report touches on several issues that appeared across our case studies: relatively ample funding for polio eradication as compared to RI, and a reluctance to rely on polio funding, which will not exist indefinitely.

It also illustrates that in certain times and places, governments have been able to use foreign polio funding to bolster limited domestic funding for RI. Ethiopia's assertiveness in ensuring support for its RI program was a key factor in securing these benefits.



Children receiving vaccine during a campaign in Ethiopia

4.4 Cold Chain

The Cold Chain and Polio Eradication. **The cold chain is the clearest example of a system essential to polio eradication that is truly integrated.** Across the world, polio eradication requires a functioning cold chain to deliver heat-sensitive OPV to the farthest reaches of the planet. This cold chain is **shared** with other programs, and used for keeping other vaccines at the appropriate temperature as well.

The Cold Chain in Our Case Studies. A functioning cold chain existed in all of our case studies. In some case studies (Rautahat, Nepal; Purba Champaran, Bihar; Camucuio, Angola; Kumbotso, Nigeria; and South Omo, Ethiopia) there were reports of temporary breaks in the cold chain in some areas. In all case studies, the cold chain was shared among many programs, and received funding and inputs from a variety of sources.

Positive Impacts on Routine Immunization. **Polio eradication funds provided key improvements to and maintenance of the cold chain system across the world.** The improvements documented in our case studies are described below. **In all cases, these cold chain improvements were used for RI. Also in all cases, polio was not the sole contributor to cold chain creation or maintenance.**

When polio eradication started campaigns in the mid-90s, they substantially strengthened the cold chain in many areas. While interviewees and/or documents confirming that this was the case were not available in all case studies, we were able to confirm this in Rautahat, Nepal and Purba Champaran, Bihar (see Cold Chain In Focus). In Rautahat, Nepal and Camucuio, Angola, polio funding provided permanent vaccine carriers that were immediately used for the transport of routine vaccines.

Polio funds were used for substantial cold chain upgrades in several case studies. In Rwanda, polio funding provided the upgrades to the cold chain needed to accommodate the pneumococcal conjugate vaccines. In Ethiopia, substantial cold chain strengthening was provided by polio eradication in 2004.

In many of our case studies, polio funding contributed to ongoing repair and maintenance of the cold chain. In Rautahat, Nepal; Purba Champaran, Bihar; Kano, Nigeria; Rubavu, Rwanda; and Karachi, Pakistan, we obtained evidence of polio contributions to ongoing cold chain maintenance (though it is one of many contributors in all cases). A respondent from Ethiopia noted:



Photo. Vaccine carriers provided for polio campaigns were also used for RI in many case studies.



The campaign helps us to increase the capacity of refrigerators. Damaged refrigerators get maintained during campaigns and ice packs and vaccine carriers are provided. The focal person manages the use of the cold chain and controls the vaccines. I can say the campaign has helped a lot...

During campaigns, polio eradication provided additional support to the cold chain, including:

- **Fuel costs and additional repair funds, as well as other inputs, were often provided during campaigns.** In Rwanda and Ethiopia, polio funding provided kerosene to

power refrigerators in health centers without reliable electricity. Also in Rwanda, workers received additional cold chain training prior to campaigns. In Nizamabad, Andhra Pradesh, we observed extensive measures taken to avoid cold chain breaks during the campaign, including obtaining assurances from the electric department that no “load shedding” (breaks in electricity) would affect the health posts on campaign days.

- **Supervisory checks of the cold chain during campaigns were observed in most case studies.**

Negative Impacts on Routine Immunization. In regards to cold chain procedures and infrastructure associated with polio eradication efforts, the study found no conclusive evidence of negative effects on RI.

Impacts on Primary Health Care. Few direct impacts on PHC were observed. In the relatively few cases where PHC supplies available at health posts in our case studies required refrigeration—for example, in the case of snake anti-venom serum in Purba Champaran, Bihar—the impacts on those supplies were the same as for RI vaccines as the cold chain was entirely shared. One notable exception was Rubavu, Rwanda, where some health centers mandated that drugs such as ocytocin used during deliveries be held in separate refrigerators from those storing RI vaccines.

Missed Cold Chain Opportunities. We did not observe major missed opportunities for polio to contribute to the cold chain in our case studies. **Since the cold chain was shared in all cases, this is in many ways a model for how polio can contribute to health system strengthening.**

Recommendations for the Cold Chain. While polio was responsible for major improvements to the cold chain in some areas, at this point it is being maintained by a wide variety of actors in all case studies. **Few immediate actions are needed to expand polio’s impact as the cold chain already benefits a variety of programs.**

This is not to say that the cold chain could not bear further improvement in many of our case studies. For instance, in the cases of South Omo, Ethiopia; Rautahat, Nepal; Camuciuo, Angola; and Kumbotso, Nigeria, there was room for cold chain improvement (especially with respect to maintenance). It is worth noting too, that cold chain needs for RI, which include the need for trained staff in vaccine handling and stock management, go beyond what polio routinely provides.

It would be worth considering the following questions in a country-specific post-polio plan:

1. Are there any inputs that polio eradication is providing to the cold chain that are unique (i.e., no other programs are currently also providing these inputs)?
2. If necessary, how can it be ensured that such services will be provided moving forward?



In Focus: COLD CHAIN

One Assistant Nurse-Midwife's Experience in Purba Champaran, Bihar, India

The woman whose interview is excerpted here has worked as an Assistant Nurse-Midwife (ANM) in Purba Champaran, Bihar, India since 1987. Her interview below, translated from Hindi but otherwise in her own words, describes her experience working in the early 1990s. She elaborates on polio's impact on the cold chain in 1995, in what was, at that time, a rural part of India with severely limited infrastructure.

There was no doctor there. There was a large river that had to be crossed to get there, and no bridge. Nahinapakari bridge, Pakaridiyal bridge, they weren't there... If I had to go to Motihari for work, I could cross in a boat.... Once a month we had a monthly meeting. We came from 17 kilometers away, it took 3-4 hours on foot.

At that time, RI happened once a month, on the 20th. We would order the vaccine from Motihari. And a peon would bring the vaccine from Motihari in a vaccine carrier. We would get the children together; the peon would vaccinate the children, and make a report. There weren't the kinds of report forms there are now! We would just write down, on a blank piece of paper, how many children were vaccinated, how many pregnant women were vaccinated, and the peon would take it in and submit it.

"The cold chain changed in '95, when polio rounds started. At first, polio rounds were held in the schools... it's then, in 1995, when the freezers came and we got a cold chain... And then, after that, we started to have RI every week. One day a week."

Interviewer: Did most people immunize their children back then?

No! People didn't understand! People would tell me, "Aare baap re, don't stick a needle into my kid!" Then we tried to explain to them, we had to do it.

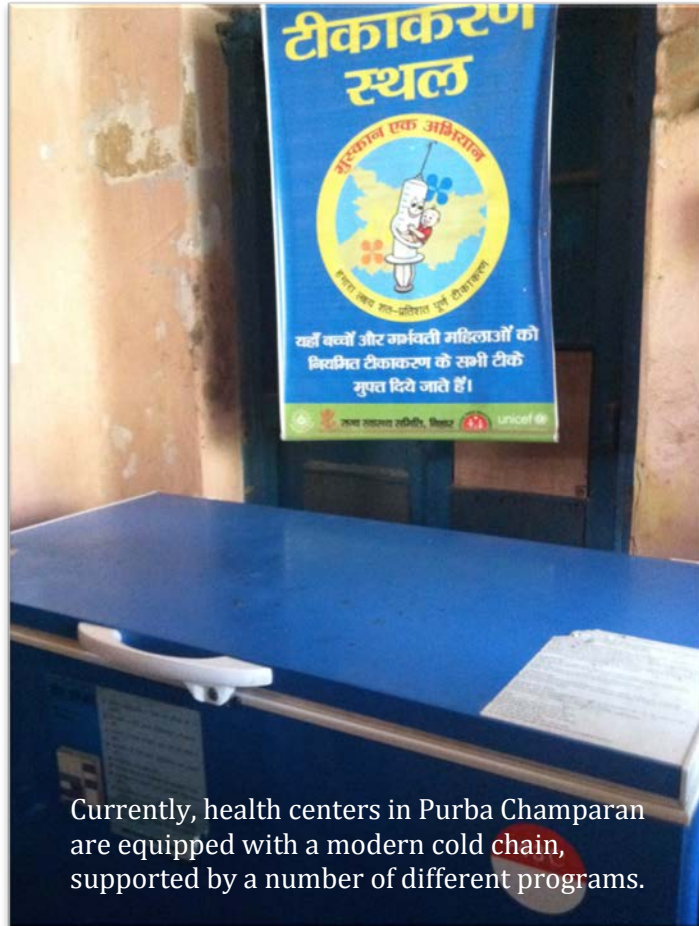
Interviewer: And the cold chain?

Well, the cold chain changed in '95, when polio rounds started. At first, polio rounds were held in the schools... it's then, in 1995, when the freezers came and we got a cold chain... And then, after that, we started to have RI every week. One day a week.

Interviewer: So before polio it was once a month, after polio campaigns started it was once a week.

Yes. Now, now it's a different story! Now it's happening at every health center, at every *anganwadi kendra* [neighborhood child health center]. But not then.

As this interview shows, at the inception of polio campaigns in Purba Champaran in 1995, this ANM started giving routine immunizations once a week rather than once a month—which may well have led to increased vaccination coverage in her area. Given the system of reporting that she described, it is possible that this increase in coverage was not reflected in any official coverage numbers. Respondents in Purba Champaran agreed that in the intervening years, a wide variety of projects and organizations, including but certainly not limited to polio, contributed to the cold chain. It is vastly superior to what it was in the late 90s and, while not failsafe, continues to improve.



Currently, health centers in Purba Champaran are equipped with a modern cold chain, supported by a number of different programs.

4.5 Training, Monitoring and Evaluation

Training, Monitoring and Evaluation in the Polio Eradication Initiative. The success or failure of polio campaigns as a strategy for eradication is based largely on their ability to administer OPV to a very high percentage of children under the age of five. Therefore, careful training of workers as well as monitoring activities both during and immediately following campaigns are critical for detecting and addressing problem areas and ensuring the entire population is reached.

As part of the GPEI protocol, workers who are responsible for administering doses of OPV must participate in a training immediately prior to the campaign. During this training, workers may be provided with the global and country-specific statuses of polio transmission, as well as given operational training on topics including team composition, outreach strategy and community mapping, administering and handling of vaccines, finger and house marking, form completion, and essential equipment (65).

The polio program utilizes several tools to monitor and evaluate worker performance during campaigns, including: forms to collect data on the preparedness of health centers or district health offices; vaccination tally sheets; rapid assessments by independent monitors; evaluations on vaccination teams' and supervisors' quality of work; and more focused reports on topics such as refusals or communications. Based on the information collected from these tools, program administrators then evaluate the success of the campaign based on predetermined indicators such as the number of children reached/missed, percentage of houses marked correctly/incorrectly during door-to-door activities, and percentage of parents who were aware of the campaign prior to the arrival of the vaccination teams (66).

Training and Monitoring Activities in Our Case Studies. **In all of our case studies, all staff working on polio campaigns were trained prior to the round, and polio activities and indicators were supervised and monitored closely by an assemblage of partners.** Staff from WHO, ministries of health, district health offices and local health facilities carefully monitored vaccination activities, while UNICEF officials did the same for communications strategies. If a campaign site was not meeting coverage targets as expected, those overseeing the overall campaign or even a specific campaign site were sometimes granted flexibility to change tactics.

Training, supervision and monitoring for other health services beyond polio ranged from nonexistent to exemplary in our case studies, depending on the service in question and the area. **In many cases, monitoring systems for polio were stronger in certain respects than other monitoring systems** (see the case of RI coverage evaluation in Nizamabad, Andhra Pradesh in the Outreach to Marginalized Populations In Focus section).

Positive Impacts on Routine Immunization. Across nearly all case studies, respondents noted that **information on the technical capacity of health facilities (like cold chain infrastructure and vaccine availability) collected during polio campaigns' monitoring activities provided benefits to RI as well.**

In a few case studies, more direct RI monitoring was incorporated into polio monitoring. For one example, see Outreach to Marginalized Populations In Focus.

In a few other cases, polio monitoring has inspired improvements in RI monitoring. For example, in Rautahat, Nepal, the use of supervisory check-lists started with the polio campaigns and is now used for RI as well. However, follow-through on the information collected in the RI checklists may be inconsistent.

Positive Impacts on Primary Health Care. In all case studies, trainings for polio workers did take place prior to scheduled campaigns. **In the majority of case studies, trainings focused on polio-related information.** Beyond the areas mentioned above, **the monitoring and evaluation tools created by the polio program and/or the information gathered from them were only rarely being utilized to strengthen RI or PHC programs.**

However, due perhaps in part to the fact that polio campaigns in **Kumbotso, Nigeria and Rubavu, Rwanda** also provide other services to the public, **training materials** in these case studies **laid out clear plans to transfer additional knowledge and skills to workers**. In Kumbotso, topical areas that extended beyond polio included antigen administration, guinea worm surveillance, social mobilization strategies, interpersonal communication skills, and data management (67). Based on this list of subjects, it seems as though trainings (despite being centered around polio eradication) are designed to build the capacities of community-level workers in other areas. A similar, very detailed training guide was also used in Rubavu. Unfortunately, study researchers were not able to attend trainings administered in Kumbotso or Rubavu to verify whether or not they are being conducted as thoroughly as envisioned in the training guides.

In certain cases, campaigns were an opportunity to collect information on PHC activities. In “high risk” blocks in Purba Champaran, Bihar—blocks that were included in the 107 Block Plan (see Social Mobilization In Focus)—PHC information and monitoring systems, such as newborn registries, were verified and updated during the campaign.

Negative Impacts on Routine Immunization and Primary Health Care. **No clear negative impacts on RI or PHC activities from polio eradication’s training, monitoring, and supervision programs were observed in any of our case studies.**

Missed Opportunities in Training and Monitoring. As mentioned in the Worker Time Allocation section of this report, polio campaigns are comprised of a variety of frontline health workers. Given that they are already attending polio trainings, **adding to or reinforcing workers’ knowledge on health topics beyond polio during polio trainings would be an easy to implement, potentially high-yield addition to the polio program.** These topics could include areas where the health sector may be weak, current and pressing health concerns, or newly established health policies and protocols.

There were also missed opportunities in monitoring. Some of the information gathered by polio eradication, such as the reasons for parental refusals, could be valuable in forming outreach strategies for both RI and PHC.

Barriers to Seizing Opportunities. **There are very few barriers to making some simple additions to training and monitoring protocols—all of which could occur now.** These steps should be taken as soon as possible, as they are fairly simple to implement and could have significant benefits.

Recommendations for Worker Training and Program Monitoring. The recommendations in this section are focused on the short term, on expanding needed services in weak health systems. **These additions are easy.** They would take limited resources and limited time.

Polio trainings—especially if they are repeated—should be considered an opportunity to build staff capacity in a variety of areas. Including a new module on a different health issue in each training would also alleviate ‘training fatigue’ in the case of workers who may be tired of being told the same information round after round.

Local and national administrators should think critically about the information gathered during polio campaigns and how this information may be valuable to other health programs. For example, copies of independent monitors’ rapid assessments and/or relevant special reports could be provided to other PHC outreach activities to strengthen knowledge of hard to reach areas, parental refusals, etc.

A quick question on a key health indicator of interest to another program could be added to post-campaign monitoring. For example, the monitor could note whether or not a family has RI vaccination cards. Or, they could note an indicator like the water source the family uses. Collecting such simple information would take only a few seconds of the monitor’s time and could facilitate the creation of important new datasets.



MONITORING

Pakistan's Monitoring Systems

In Pakistan, **there were at least four major monitoring systems used to assess how polio eradication's services were being delivered.** First, after each campaign there was an “independent monitoring” protocol for checking houses to obtain a measure of campaign quality. Second, because the results from such independent monitoring were not always reliable, Pakistan instituted “Lot Quality Assurance Sampling,” or LQAS, an additional method for taking a sample of children to assess campaign quality. Third, UNICEF had a monitoring system focused on process indicators of social mobilization and planning. Finally, the AFP surveillance system collected information on how many doses of OPV children had received, allowing planners to identify pockets of zero- or low-dose coverage in the country. While none of these methods were perfect, together they gave polio planners a fairly robust idea of where campaign quality was below par.

In Pakistan, existing information on RI coverage at the district level or below was not as strong as data on polio campaign coverage.

Administrative coverage numbers were often unreliable. The Pakistan Social and Living Measurements Surveys provided one method of assessing coverage, but they were not failsafe. DHS and EPI data on immunization coverage did not give high-level resolution at the district or sub-district level, or information on yearly changes in coverage.

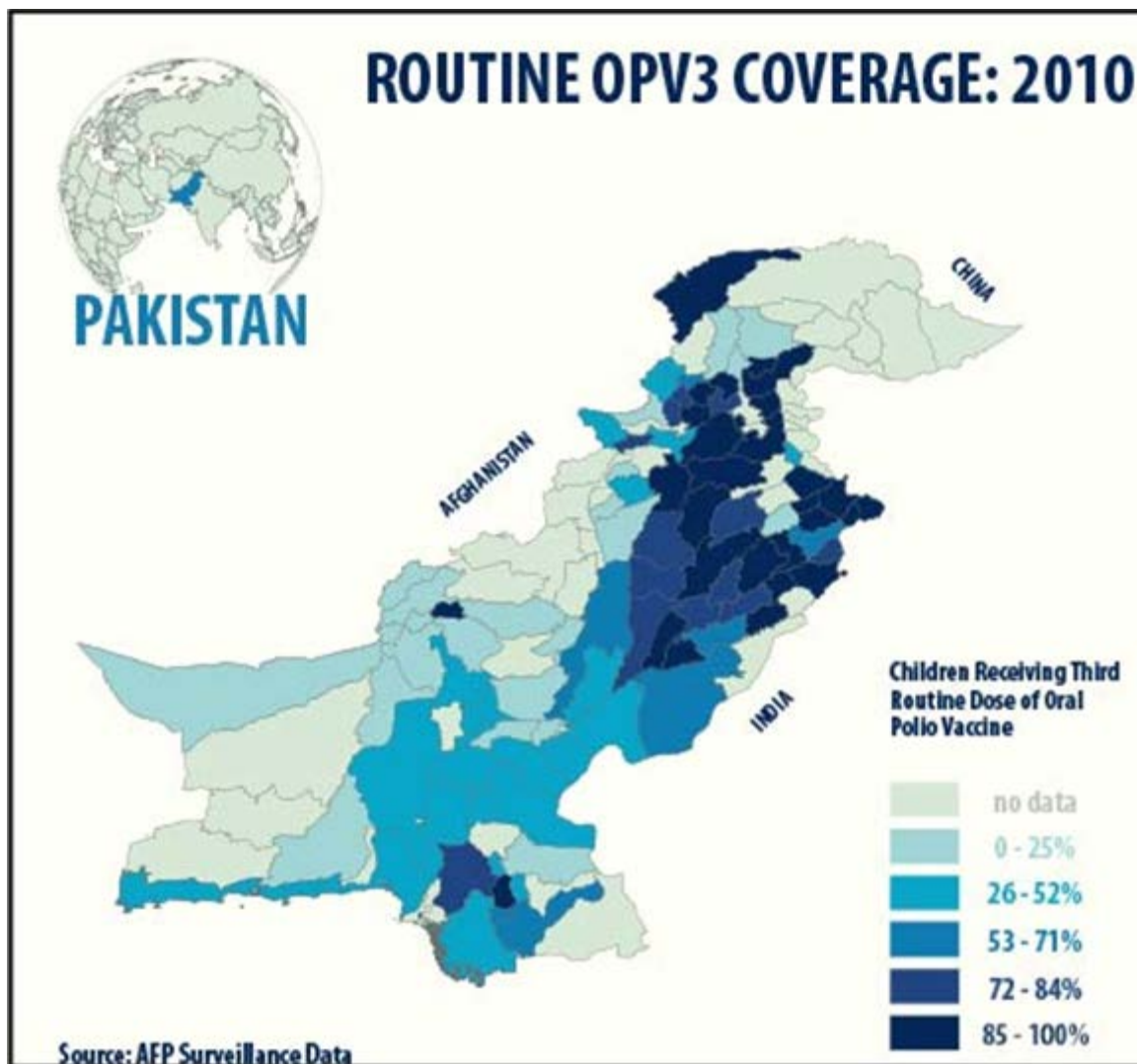
Some of polio's monitoring systems had positive spillover effects for information on RI coverage.

Pakistan's AFP surveillance system collected information on routine doses of OPV. As cases of non-polio AFP were a reasonably random sample, this system could be used to assess RI coverage in children of different ages (in fact, we found it very useful in the current study for that purpose). In addition, there were some more piecemeal impacts. While the LQAS methodology did not normally include information on RI coverage, some enterprising individuals had included it in a few places.



In Pakistan, polio eradication's monitoring systems also provided some information on RI coverage

The potential for stronger information systems on RI, supported by polio eradication, exists. There is untapped potential in the independent monitoring, LQAS, and UNICEF systems for collecting more information on RI coverage—the addition of a simple RI indicator to each of these monitoring systems could provide more robust data on RI coverage, potentially yielding valuable new insights. **However, all of these systems were primarily maintained by UN agencies, raising questions of sustainability.** As with many other systems highlighted in this report, the ways these systems could best be transitioned, supported, and integrated into a new, high-quality system post-polio is worth attention.



Pakistan's AFP surveillance system, unlike most in our study, collected information on **routine** doses of oral polio vaccine—an alternate and useful measure of routine immunization coverage.

4.6 Worker Motivation

Polio Eradication's System for Motivating Workers. Although attention has recently been given to this issue (63), **there are no standard protocols in polio eradication geared toward increasing worker motivation.** Responsibility for determining the best means of motivating the polio eradication workforce falls to implementing countries.

Worker Motivation in Our Case Studies. In general, **health workers appeared to be fairly motivated to work on RI and PHC activities across many case studies**, many stating that they enjoyed their work, particularly as they felt they were contributing to society.

Exceptions to this trend were striking **in areas where pay was late or unreliable, supervision was weak, or advancement based on political connections rather than commitment.** In such areas, **workers might not show up for their RI and PHC duties at all.** In SITE Town, Karachi, Pakistan, some workers complained that they had not seen any salary payments in five months, and in some areas Lady health Workers and Lady Health Supervisors were on strike. Some doctors stayed at their posts only an hour or two each day. Inconsistencies in supervision and service provision were also noted in Rautahat, Nepal, Purba Champaran, Bihar, and Kumbotso, Nigeria.

Other times, problems related to worker motivation were limited to just one type of worker. For example, in Purba Champaran, Bihar, India, anganwadi workers and auxiliary nurse midwives— frontline workers contracted by two different government departments—were paid on time. While many auxiliary nurse midwives were overqualified for their jobs (many had trained as nurses but were not permitted to use their skills), they performed their duties as expected, despite some professional-related frustrations. In contrast, many Accredited Social Health Activists (ASHAs)— frontline workers with incentive-based pay—said they were not working at all because payments for the PHC services they provided were months to years late, and might never arrive. One ASHA explained her frustration regarding incentives for attending deliveries, which she said had just been disbursed after a delay of four years:

Deliveries cannot be scheduled: they happen in storms, in the rainy season, at night, in hot and cold. We ASHAs arrange the delivery, go to the hospital, and stay there for 4 or 5 hours—8 or 9 hours in some cases. And then, there is no medication in the hospital, so we buy it ourselves. That's what we do for deliveries. In return, what does the government give us? Pay after four years. How can we manage?

Legitimate complaints unrelated to polio, then, were strong determinants of worker motivation. (It should be noted that the ASHAs in Nizamabad, Andhra Pradesh received their pay in a timely manner and were performing duties as expected.)

Positive Impacts on Routine Immunization and Primary Health Care. **In areas that consistently experienced only a few campaigns per year** (Camucuo, Angola; South Omo, Ethiopia; Nizamabad, Andhra Pradesh, India; and Rubavu, Rwanda), **the effects of the polio program on worker motivation were generally neutral or slightly positive.**

The increased presence of officials and supervisors during polio campaigns was credited with motivating health workers, even those health workers not involved in the polio campaigns (whether this was a carrot or a stick was not always clear). Even in Rautahat, Nepal, which experienced up to 11 campaigns per year in 2010, it was noted that health workers seemed more motivated during campaigns because of increased oversight.

The successful elimination of polio might provide a bump to worker motivation. This was mentioned by senior officials in Purba Champaran, Bihar, India. However, this effect was mitigated by the fact that despite the elimination of polio, there were still 11 campaigns per year in the district, leading to frustration, described below.

Negative Impacts on Routine Immunization and Primary Health Care. **In areas with many campaigns per year, polio eradication’s effects on worker motivation were more negative.**

Some workers voiced dissatisfaction with repeated campaigns and the burden of work they entailed. Fatigue due to repeated immunization campaigns was mentioned in all case studies with a large number of campaigns per year, including Purba Champaran, Bihar; SITE Town, Pakistan; and Kumbotso, Nigeria; however it also continued to be a low-level complaint in Rautahat, Nepal, which recently decreased the number of campaigns from 11 to 4 per year.

“Polio, polio, polio,” said a district-level official in Purba Champaran. “Workers, motivators, vaccinators, we have threatened them a lot, from the government side. Now they have closed their ears.”

Others complained that campaigns pull human resources from health posts and centers, leaving the remaining workers understaffed and overburdened. This complaint was mentioned specifically in Kumbotso, Nigeria; this dynamic is discussed in more depth in the Service Interruption section of the report.

Low monetary incentives provided to polio workers for their involvement in the campaigns compounded workers’ overall dissatisfaction in many cases. See Monetary Incentives In Focus for further information.

Workers who had to repeatedly confront distrusting or hostile populations during polio campaigns found this demotivating. In SITE Town, Karachi, Pakistan there are many displaced people from the war in Afghanistan. A United Nations staffer who worked in that area explained, “They get angry and say: ‘You save children here but what about in our homes? There, children are dying and no one does anything. You should be working where the war is.’” Repeated exposure to such complaints in campaign after campaign—issues that the workers in question had little power over—wore on many workers.

Missed Opportunities. **Polio trainings, which often focus on information about the vaccine and the cold chain, could be better used as an opportunity to motivate workers.** See the section on Training, Supervision, and Accountability for more information.

Recommendations. **In high-intensity areas with numerous campaigns per year, there is an urgent need to better communicate to workers why repeated campaigns are necessary.**

Also, in some cases, low per diems contribute to worker dissatisfaction. See Monetary Incentives In Focus for more information. In these instances, **the options of raising monetary incentives to a living wage or eliminating them entirely** (to encourage volunteerism), **should be considered depending on the area.** It should be noted that eliminating incentives is more likely to be successful in areas with high and reliable regular wages, and a limited number of campaigns per year.



In Focus: WORKER MOTIVATION

Monetary Incentives for Campaign Work

Across the case studies, health staff and ‘volunteers’ who worked on polio campaigns received monetary incentives for their work. The table below includes the amounts workers were paid (in US dollars), as well as the number of paid workdays in a given year (should workers participate in every campaign).

Case study	Worker type	Total US \$ earned / day	# of (potentially) paid working days / year
Nizamabad, Andhra Pradesh, India	Non-health volunteers and health staff	\$1.45	6
Purba Champaran, Bihar, India	Non-health volunteers and health staff	\$1.45	66
Rubavu, Rwanda	Recorders	\$1.60	3
	Social mobilizers	\$40.10 (placed into shared community cooperative after each campaign)	N/A
	Vaccinators (nurses)	\$8.00	3
South Omo, Ethiopia	Non-health volunteers	\$1.93	12
Rautahat, Nepal	Non-health volunteers and health staff	\$2.40	8
SITE Town, Pakistan	Non-health volunteers and health staff	\$2.42	55
Kumbotso, Nigeria	Non-health volunteers and health staff	\$4.80	32
Camucuo, Angola	Vaccinators / recorders	\$0.00 (lunch / uniform)	9
	Social mobilizers	\$16.72 (and lunch)	15

In all case studies, people administering incentives said they were not meant to be pay, but money to offset the cost of transportation and food while working. Workers’ understandings of these incentives varied; in some case studies, workers approached them as reimbursement for lunch or other expenses, while in others, workers considered the incentives pay (albeit pay that was extremely low or inadequate).

Incentives ensured worker participation in polio campaigns, even in cases where workers may not have shown up for their regular jobs. In concert with polio eradication’s more intense supervisory structure, incentives helped ensure that polio campaigns in every case study occurred as planned, even in cases where workers were not performing their other duties. In the contexts that characterized many of our case studies, such as poverty, high unemployment, and late or unreliable regular health staff salaries, incentives often provided a bit of much-needed cash to health workers. In SITE Town, Karachi, where regular pay was very unreliable, workers relied on the predictable income that campaign per diems provided—and were thankful for it.

In case studies with fewer campaigns per year, monetary incentives were seen as neutral by workers, or as positive and motivating. In Rubavu, Rwanda, Camucuo, Angola, and South Omo, Ethiopia, workers said they were motivated by and grateful for the amounts received. In Rubavu, workers saw their participation in the campaigns as voluntary, and the incentives provided were not understood as payment for work, but reimbursement for possible travel expenses. In Nizamabad, Andhra Pradesh, India, health workers said that the incentives had no bearing on their motivation to work on polio campaigns.

In case studies with many campaigns per year, complaints were expressed over the size of incentives, and many workers said the small size of the incentives made them feel angry and demotivated. In interviews, workers repeatedly voiced frustrations that they were paid so little for such a large amount of work. **These frustrations were especially acute in Kumbotso, Kano, Nigeria, and SITE Town, Karachi, Pakistan,** but they were noted in Rautahat, Nepal and Purba Champaran, Bihar, India as well.

In several case studies, concerns that incentives discouraged volunteerism for other health initiatives were articulated. Respondents in Rautahat, Nepal and South Omo, Ethiopia stated that providing monetary incentives negatively affected volunteerism, as health staff and community members were now unwilling to work on campaigns for other health issues unless they were provided a per diem.

The effects of polio campaign incentives, then, were highly context-specific, and in some cases they had unintended negative consequences on worker motivation more generally. The options of eliminating or increasing incentives should be carefully considered on a case-by-case basis.

4.7 High-Level Attention

High-Level Attention to Polio Eradication. Globally, high-level attention to polio eradication is in high supply; certainly it does not suffer in this regard in comparison to RI and PHC. As we write this report, UN Secretary-General Ban Ki-Moon, Bill Gates, and Presidents Hamid Karzai (Afghanistan), Goodluck Jonathan (Nigeria), and Asif Ali Zardari (Pakistan), among others, are gathered in New York at a polio meeting.

This international attention is brought to bear on countries that are still harboring polio transmission. And this tactic is reasonably effective in securing high-level attention to polio eradication within those countries. In case studies with recent polio transmission, photographs of presidents and prime ministers meeting with WHO officials and administering drops of OPV to babies were in high supply.

High-Level Attention In Our Case Studies. In our case studies, across the board, polio received as much or more attention than any other health issue from high-level officials, including visits to the district from health and political leaders. Campaign inaugurations like this one described by a fieldworker in Purba Champaran, Bihar, India were common:

The school has a covered porch, and on the porch there is a circle of chairs, with probably 10 rows of chairs behind them, about half of them filled with health officials. It seems like the whole village is there waiting. A chorus of loud, animated voices fills the air as everyone waits in anticipation for the District Magistrate



Staff in Purba Champaran, Bihar, India received monetary incentives for polio campaign work.

(DM). It reminds me just a little bit of people along a parade route. Some of the medical officials pass out paper fox facemasks to all the young children. The DM arrives with great fanfare in an Ambassador amongst a train of cars. The DM joins the District Immunization Officer (DIO) in the circle of chairs. The DIO says a few words, and then a few of the women who were waiting inside the school go outside, holding their babies to be vaccinated. (It appears that they have already been selected). The DM, and then also the DIO and the Civil Surgeon give the infants polio drops to inaugurate the campaign. As this happens, the crowd surges forward to see. All the medical officials previously seated in chairs on the porch are standing up, some taking pictures. Swarms of men have crossed the roads and are standing practically touching the chairs, jostling to watch. Once the few polio drops have been ceremoniously given, the DIO, Civil Surgeon, and the District Magistrate all give speeches.

In many—though not all—case studies, such attention by high-level health and other officials was unique to polio. Some of these visits were largely ceremonial, while others served much more substantive purposes.

Positive Effects on Routine Immunization. **Some visits by high-level official during campaigns had positive effects on RI as well.** As discussed in the sections on worker motivation and supervision, as well as High-Level Attention In Focus, officials who visited districts for polio campaigns were often able to bring added attention to RI.

Recently, several high-level polio bodies have given attention to the need to strengthen RI. The India Expert Advisory Group on Polio Eradication has recently turned its attention to best practices of polio activities strengthening RI, and has advocated the rollout of such activities across more of India (64). Angola's Emergency Plan for polio eradication devotes extensive space to detailing ways to improve RI (68).

Also, according to the most recent report from GPEI's Independent Monitoring Board (69), partner agencies must put better thought into how polio eradication efforts can contribute to other areas, especially RI:

Many of the partner agencies have separate exciting visions for the future of global health (other elimination initiatives, strengthened routine immunisation programmes, universal healthcare) but fail to meaningfully set out the many ways in which the Polio Programme can contribute.



Photo. Nigeria's PHC Coordinator visits with a polio victim during the February 2012 polio campaign.

The report even goes on to stress that polio-free countries, such as Chad and the Democratic Republic of the Congo, with “low routine immunization coverage means that there is very little protective buffer against further outbreaks [of polio] taking hold.” It is therefore evident that the international players involved in polio eradication are already taking a serious look at this issue.

Negative Effects on Routine Immunization. **International pressure to focus on polio may force national-level officials to focus on polio to the exclusion of RI.** A number of commentators in India have criticized the focus on polio there (70–72). Similarly, one high-level respondent in Pakistan elaborated on the focus on polio compared

with the way national decision-makers think about, and give attention, to RI. “Honestly speaking, I’ll say attention [to RI] has been reduced. I can’t tell you if it’s a result of polio or not, but if you compare [RI] with polio, yes, [the attention] is very minimal [and] almost nil. For policy makers, politicians, and the bureaucrats, if we talk about immunization they understand it as ‘polio’, and not the other way around.”

Positive Effects on Primary Health Care. **In certain case studies, the opportunity for intersectoral collaboration between health and other departments (initiated by polio eradication efforts) was a substantial positive.** In Nizamabad, Andhra Pradesh, India, we observed a district-level, multi-sector coordination meeting prior to conducting the polio campaign. Participating departments included Women and Child Development, Education, Health, and Revenue. During this meeting specific responsibilities, including event setup and oversight of both campaign staff and mobilization activities, were dealt out to various departments’ officials. While this meeting focused on polio, and thus did not lead to direct collaboration on issues of PHC, respondents in the district mentioned that intersectoral collaboration fostered by polio was very beneficial overall.

The 107 Block Plan is another example of intersectoral collaboration (see Social Mobilization In Focus).

Negative Effects on Primary Health Care. **Planning and attention for other issues may at times be given short shrift for polio SIA planning.** “Polio, polio,” a frustrated immunization official said at a meeting in Purba Champaran, Bihar. “When is anyone ever going to pay attention to anything else? It’s been eradicated!”

In the spirit of the definition of PHC formed at Alma-Ata, the goals and services of a health system should ideally be determined by the communities served. The eradication of polio was not the primary health concern of community members in our case studies. From this perspective, **polio eradication—of necessity orchestrated globally—is somewhat antithetical to the ideal of PHC.** That said, it is not alone in this—most health initiatives in the current era are open to the same criticism.

More concretely, **there is a negative effect on local ownership and initiative when a government—at the district, state, or national level—must follow international guidelines regardless of local expertise or agendas.** This of course applies in terms of the question of whether to take on a given eradication initiative in preference over other health goals. But it also applies to the methods employed to reach those goals. It has been argued in the case of India that the global leadership of the GPEI disregarded Indian research on the efficacy of oral polio vaccine — research which might have led them to fully appreciate how difficult eliminating polio from India would be (73).

Recommendations surrounding High-level Attention. Several steps can be taken to maximize the positive effects of high-level attention on the health system, while simultaneously giving more attention to local expertise and needs:

- At the international level, use polio eradication as a platform to draw attention to issues like RI.
- In polio-endemic countries, special attention should be given to providing support for other health initiatives as well.
- The implications of the necessary erosion of local agenda-setting in the face of a global goal should be taken seriously, and steps taken to simultaneously support local goals.



In Focus: HIGH LEVEL ATTENTION

Official Visits to Polio Campaigns in Rubavu, Rwanda

Interviewees in Rwanda told us that high-level officials in Rwanda provide a great deal of attention to PHC, RI, and polio activities, all of which are considered priorities by the Ministry of Health. However, whereas officials typically managed PHC and RI activities from afar – reviewing statistics and reading reports from their offices in Kigali – the polio campaigns (seen as special because they were not routine, everyday activities) often physically attracted officials to local health centers.

Officials visiting polio vaccination sites participated in social mobilization activities and provided feedback to local organizers. This special attention brought with it benefits not only for the polio campaigns, but also for RI and PHC activities in the district of Rubavu.

The first area that benefited was increased supervision over RI activities. According to those interviewed, high-level officials who visited health centers came to oversee activities and provide strategic recommendations regarding the polio program's implementation. As a consequence, RI services were oftentimes provided with the same level of oversight. As one respondent remarked:

When anti-polio campaign activities are carried out on the same day with routine vaccination, [officials] carry out supervision of both activities. They cannot supervise some activities and leave out others, while they have come to perform field activities. So, they play a considerable role in these activities.

Although respondents did not doubt national officials' commitment to RI activities, many stated that in-person visits to oversee these activities were rare or non-existent. As stated by another respondent:

[High-level officials] are not involved in routine vaccination activities, but when there is a campaign, they are fully involved to make sure that all children are vaccinated because they are accountable for it.... During the campaign they double their efforts to facilitate this activity.... They are not actively involved in routine vaccination activities; they just read reports about it. They only participate actively [in RI] when there is a campaign.

Respondents agreed that this increased supervision over RI was in many ways helpful, as it provided officials with a better perspective of the current, on-the-ground challenges faced by health centers, often difficult to convey through reports alone.

The second area that benefited from high-level officials' presence was **worker motivation**. Many interviewees stated that officials' presence motivated workers to better perform their duties on campaigns, as well as their routine activities. According to one frontline worker, "When there is polio eradication campaign, we receive many visitors



A nurse administers polio drops during the January 2012 polio campaign.

who supervise the performance of the activity. And this motivates even those who do different activities from this one in changing strategies." Therefore, the high-level attention provided to polio campaigns motivated all health staff during this time, even those who worked outside of the campaigns. This motivation likely had a direct, although possibly fleeting, effect on the quality of health service provision in the district.

Finally, according to those interviewed, the presence of high-level officials during polio campaigns often drew the attention and curiosity of the public. Officials then seized this platform created by the campaigns to **mobilize the population** to partake in other immunization events and health services. As stated by one interviewee:

When the polio campaign is under way, all authorities are involved and when they sensitize people to come for [polio] vaccination, they put more emphasis on the routine vaccination program. If the routine vaccination is well done, it should not be necessary to organize the campaigns.... [Also] polio eradication is integrated with other health matters; it doesn't go on alone. For example, when polio campaign is under way, [high-level officials] can sensitize people about good nutrition, cleanliness, family planning, etc.

In summary, primary healthcare and RI services in the district of Rubavu benefited in many ways from high-level officials' active participation in the polio campaigns. Not only did their presence bring stronger supervision of RI activities, but it also motivated health workers and stimulated the public to partake in other health services. The fact that this platform was created by campaigns, but then used for these additional purposes, illustrates how high-level attention generated by polio activities can benefit other areas of RI and PHC when officials are committed to promoting a range of services.

4.8 Public Awareness and Satisfaction

Social Mobilization and Polio Eradication. Social mobilization—raising public awareness about the importance of polio vaccination—is largely the responsibility of UNICEF within GPEI. From high-profile mass media spots like India’s campaign featuring Bollywood stars Amitabh Bachchan and Shahrukh Khan, to repeated door-to-door visits by social mobilization staff, polio eradication’s extensive social mobilization infrastructure aims to create demand for polio vaccination.

The extent of social mobilization activities for polio varied widely among our case studies. In some—like Purba Champaran, Bihar—UNICEF had a large frontline staff aimed at encouraging acceptance of polio vaccine. In others—like Rubavu, Rwanda—there were no UNICEF staff permanently stationed in the district.

Public Awareness and Satisfaction in Our Case Studies. **Public awareness of vaccination in particular, and health services in general, had increased markedly in the past 15 years in many of our case studies.**

Interviewees in Rautahat, Nepal; Purba Champaran, Bihar, India; and Nizamabad, Andhra Pradesh, India noted a great increase in acceptance of vaccines and other health services since the 1990s. Similarly, in Camucuo, Angola, respondents said that public awareness of health services had increased markedly since the end of the country’s civil war in 2002. A respondent in Camucuo said:

I think it has changed a lot because previously, even people who would be considered well-off in society would refuse to allow their child to be vaccinated, but nowadays, this does not occur. Even the mothers from lower social levels, when we go to the communities to inform them, they do not even wait for us to get to their door. They truly want their child to be vaccinated.

In no case study was there any evidence that public awareness had decreased.

Satisfaction with health services was, perhaps not surprisingly, linked more to the quality of those services than with any other factor, including social mobilization activities or polio campaign activities. Interviewees in many case studies noted that increasing awareness was linked to increasing demands for quality health services—demands that were not always met.

Officials in several case studies were reflective and self-critical on this point. A national-level official in Nepal said, “I don’t know how much government has improved to meet the demands from the community, but the community demands have increased in the last 12 years.” Other respondents in the Rautahat, Nepal case study said that satisfaction was linked—again, perhaps not surprisingly—to whether the health facility was open, and whether staff and medications were available.

Similarly, an official in South Omo, Ethiopia said:

As I see it, provision of health services are lagging behind the demands of the people in health. They are aware of preventing diseases. But the services provided are not enough... One farmer told me, “When my wife delivers I will sell my ox and go to where the service is better.” And when we asked him why, he said, “The health post is full of dust, and service is poor, and I want my baby to be healthy.” The community’s understanding is improving, and they need health services, but they are not satisfied. Official policy says communities should be able to access health services within two hours but some communities must go more than 6 to 10 hours. There are gaps still.

Positive Impacts on Routine Immunization. **In many case studies, polio eradication activities likely contributed to an increase in public awareness of RI, but they were not the only contributing factor.** The opinion of this frontline worker in Purba Champaran, Bihar was typical: “In every village, there’s an anganwadi worker, an ASHA, an ANM... they all go to tell people about health. They explain things. That’s how people learned.”

The community health workers mentioned in this quote (anganwadi workers, ASHAs, and ANMs) all work on polio campaigns—as such, it is extremely difficult to disentangle polio-specific impacts from the impacts of their general work, which includes social mobilization for RI and PHC activities. Across case studies, respondents were more likely to attribute increases in awareness to the overall work of community health workers, or to mass media, than polio activities specifically.

In some case studies, respondents noted that polio campaigns provided an opportunity for face-to-face communication about RI and other health services. For example, a frontline worker in Rubavu, Rwanda said, “The role played by the anti-polio program is that it offers the opportunity for people to meet, and they are taught about polio and, after, they take the opportunity to ask even other questions related to other important issues, and they get explanations.” The extent to which this opportunity was seized varied across case studies; it was to some degree largely dependent on the initiative of individual workers.

In most of our case studies, polio’s social mobilization materials focused on polio vaccination. Attention to RI coverage was the exception rather than the rule. A notable example was India’s 107 Block Plan (see Social Mobilization In Focus).

As such, many respondents in many case studies were skeptical that polio eradication deserved much of the credit for increased public awareness. A respondent in Nizamabad, Andhra Pradesh, India said, “We are providing awareness only on polio during the campaign. I don’t think they become aware of other health issues.”

The prominence of polio eradication may have made some indirect contributions to RI awareness. See the discussion of positive impacts on PHC, below.

Negative Impacts on Routine Immunization. **In case studies where misconceptions and rumors regarding polio vaccination were common, there were concerns that distrust and misunderstandings regarding polio vaccine would spill over into distrust and misunderstanding regarding vaccination generally.**

In SITE Town, Karachi, Pakistan, distrust regarding polio vaccine was evident: a community member interviewed during the study stated that she could not trust polio workers or the vaccine, as she felt that the vaccine used was not good quality. (Health workers said that they try to overcome these rumors by telling community members that they too have had their children vaccinated, and by relying on influential elders within communities to visit households and verify that the vaccine is safe.) It is plausible that such distrust could spill over into RI, though we do not have conclusive evidence that is happening.

Similarly, officials in Pakistan, and commentators in India, have expressed concern that people may believe that polio drops delivered during the campaign are sufficient to fully immunize their children against all diseases, and thus may not seek out RI services. A respondent in Rubavu, Rwanda stated that occasionally, parents of children scheduled for RI (around the time of the campaign) miss their appointments, believing that their children were fully immunized by the OPV doses received during the campaign.

Positive Impacts on Primary Health Care. **As mentioned in the section above on positive effects on RI, polio eradication was one of many contributors that increased the public’s awareness of health system services in our case studies.**

One contribution specific to polio, as discussed above in the section on RI, was contact with health workers during door-to-door visits. Many respondents in Kumbotso, Nigeria mentioned this as a positive aspect of polio campaigns. One front-line worker said, “The house-to-house campaign made each and every member of the public aware of polio and other health issues.”

A national-level respondent in Ethiopia described their philosophy:

But it's an opportunity so when you reach some areas, like, you can see, like during polio SIAs you can see malaria—a lot of malaria cases. So you don't say that there are malaria and you come only doing polio. You react—because there are health workers—there are people from around there. So they do such kind of activities. It's an opportunity even—to see some things. So, but now it is a systemic way of reaching them; because they are health extension workers; they go with a package [of services]—not only polio, not only routine immunization, [but] they also do other primary health care activities. That's the change.

Door-to-door visits, then, represent a substantial opportunity. It should be noted, however, that during the polio campaigns we observed in our case study districts across countries, the focus was always exclusively, or nearly exclusively, on polio vaccination.

In a few isolated cases, polio social mobilization efforts made direct contributions to PHC. The two cases in which we observed this occurring were social mobilization surrounding Nigeria's Immunization Plus Days in Kumbotso (see Integrated Campaigns In Focus) and India's 107 Block Plan in Purba Champaran (see Social Mobilization In Focus).

Negative Impacts on Primary Health Care. **No negative effects of polio eradication on awareness of PHC were noted in any of our case studies.**

In some cases, the high level of commitment, funding, and service provision in the case of polio, when compared with poor provision of other services, highlighted the public's *dissatisfaction* with those other services.

Kumbotso, Nigeria, provides a key example here. A national-level official in Nigeria said:

If you go to visit a family that has a boy of five years [of age] and tell them you want to give [their child the] polio [vaccine], the first question they will ask is, 'Why is it that when my child is ill, I go to the health facility, am not able to see the doctor, my child is not treated well by the health personnel, and I buy the medicine, but now workers come to my house to drop off the OPV to my child who is healthy.' So this is a disconnect.... For sure people are asking a lot of questions, people are disturbed that why only polio.... I want to add here is that awareness of health is an important pillar for improving the quality of life and that it should be something that should be encouraged and that people should ask questions and we the policy/technical people should provide the right answer. It is only when you provide the right answer that you will win the confidence of people and for them to accept what you have.

Respondents within Kumbotso stated that the contrast between repeated door-to-door provision of polio services and poor provision of other health services not only highlights dissatisfaction with other health services, but leads to distrust in the polio campaign. One frontline health worker stated, "People raise so many suspicious questions about polio. Some of the non-compliant people often remark that if you go to hospitals, you buy every drug. Then why is it that polio vaccine is given house to house free of charge?" Another health worker noted, "If boreholes and other essential amenities should be provided to these communities the polio vaccine would be more acceptable."

Such sentiments were not only observed in Nigeria. A worker in SITE Town, Karachi, Pakistan said: "We get asked, 'Why do we repeatedly go for the polio campaigns? Why are we worried about polio?' The people say, 'We have so many other problems.' The people have their own priorities, first is water and living in difficult situations, groceries and sanitation. They don't have their basic needs. And the polio campaign has gone on for more than 10 years."

Interviews in Angola provided evidence of a similar dynamic. While the majority of respondents stated that the public was generally satisfied with polio campaigns and other health services, there were voiced frustrations as well.

One of the five community members we interviewed expressed dissatisfaction with the health system, complaining bitterly about the lack of medications. Adding to this, one health worker said, “All the time it is polio, polio; so they have this taboo.”

Missed Opportunities to Strengthen Public Awareness. **As a number of respondents pointed out, door-to-door visits during campaigns provided an opportunity to provide information on other health issues—an opportunity that was only occasionally seized.**

In addition, with a few notable exceptions, polio messaging missed opportunities to include messages on other health issues as well.

Barriers to Seizing Opportunities. **Campaigns are time-limited and exhausting, and many workers simply do not realistically have time to do anything beyond provide polio vaccination.** Teams with a target of 200 children per day cannot be expected to provide additional health interventions or information during campaigns. (Outside of campaigns, polio eradication can be an effective platform for broader messaging activities, as the example of the 107 Block Plan illustrates.)

Messaging alone will have little effect without services available. Messaging around RI, for example, is futile if no vaccines are available in the health post.

Recommendations surrounding Public Awareness. **India’s 107 Block Plan provides a model of integrating polio, RI and PHC messaging that could be more widely emulated.** The Social Mobilization In Focus section gives information on this program.

The disparity between polio services and other health services in places with the most intense campaigns should be addressed, as a partnership between the polio program and other programs. This will have the dual effects of providing much-needed services, and dissipating distrust of the polio program.

To more effectively harness polio’s impressive and extensive social mobilization infrastructure, a country-specific post-polio plan should answer the following questions:

1. What information and infrastructure for polio social mobilization could contribute to awareness of other health issues? Now? In the future?
2. What will happen to the polio social mobilization infrastructure post-GPEI?
3. Can it be made sustainable in the long term?
4. What is the timeline for these activities? Can they begin now?



SOCIAL MOBILIZATION

India's 107 Block Plan

In 2009, the prospects for polio eradication in India looked bleak. Cases were up, polio was stubbornly persisting in a number of areas, and children who had been vaccinated multiple times were still getting polio. “There was a feeling in the program,” a UN official said in an interview, “that there was a real need to dig deeper.”

Beginning from the observation that polio transmission was primarily concentrated in just 107 blocks or subdistricts, and further recognition that, in the words of another UN official, “vaccine is not as effective in these 107 blocks,” **the program turned its attention to the underlying causes of polio transmission in these areas.** In the 107 “high risk” blocks, the program focused on **improving RI, increasing rates of breastfeeding, lowering diarrhea rates, and improving sanitation practices.** The 107 Block Plan was a far-reaching strategy that provided additional attention to enhancing the quality of campaigns while simultaneously conducting a wide variety of other activities from filling vacant medical officer positions to the construction of latrines in some cases. **In this section, we will focus on one piece of the 107 Block Plan—its extensive communications strategy.**

Polio eradication's communications strategy in India had long included RI messages, but under the 107 Block Plan, much greater attention was given to issues beyond polio vaccination—in the words of one interviewee, it was “polio plus plus plus plus.” Specific, targeted messages included information about diseases prevented by RI, the normal side effects of immunization, and where immunizations were available; the importance of oral rehydration solution in cases of diarrhea and how to prepare it; instructions to feed colostrum to infants and to exclusively breastfeed for six months; and to wash hands with soap at specific times throughout the day.



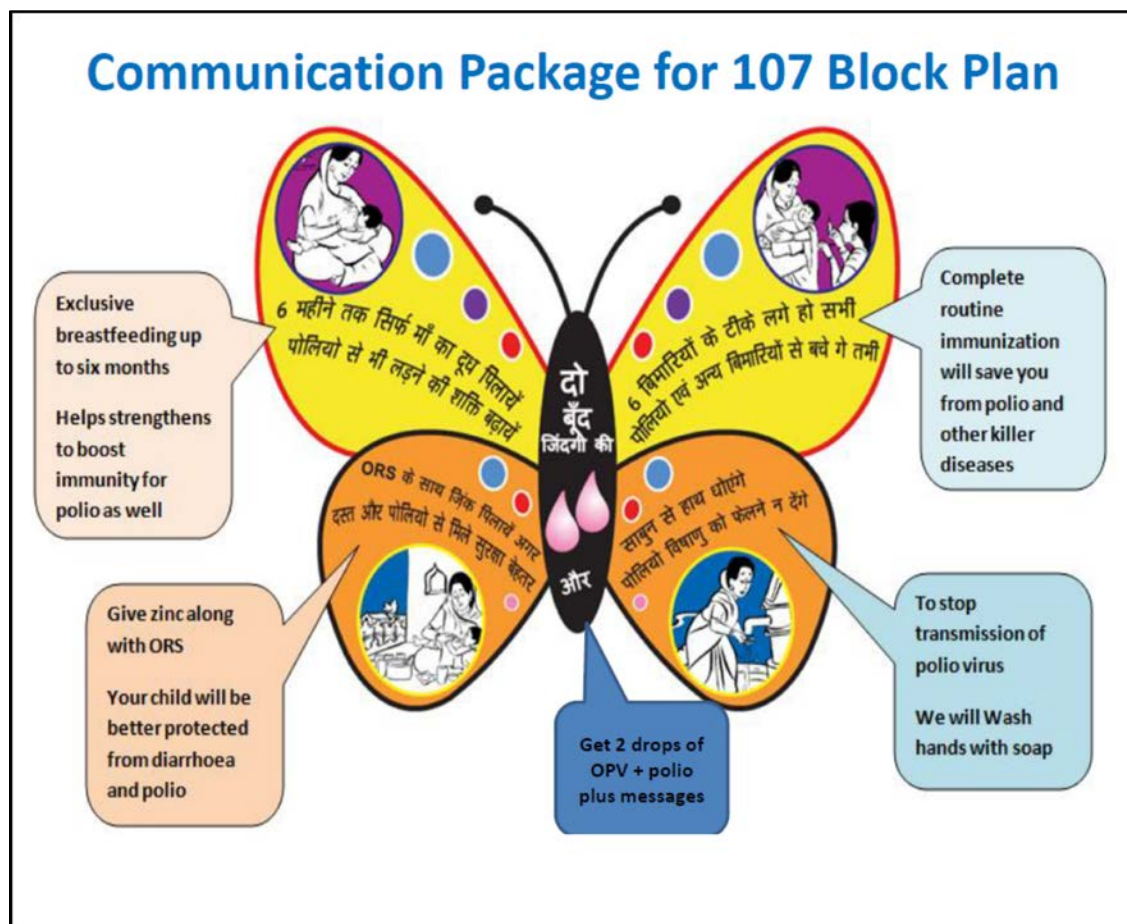
In areas of India with a high risk of polio transmission, communications staff promote routine immunization, breastfeeding, hand washing, and ORS along with polio vaccination

Additional staff were hired to disseminate these messages: up to 1,500 community mobilizers were deployed in Bihar (and even more in Uttar Pradesh). Initial concerns about social mobilizers' ability to quickly learn and disseminate these messages proved unfounded. One UNICEF official said that, rather, **the mobilizers “embraced it”**—excited that after years of the same polio messaging, they could do more.

Several blocks within our study district of Purba Champaran were included in the 107 Block Plan. A

staff member there described her work:

We are promoting hand washing.... We are promoting breastfeeding. We are promoting zinc and ORS [oral rehydration solution] for controlling diarrhea. **We conduct counseling meetings with the targeted families and slowly, slowly, it has developed awareness in their behavior....** When we interact with families, our objective is to create awareness of environmental factors as well as their behavior.



The 107 Block Plan included a range of communication messages on underlying causes of polio transmission. Image from Ogden and Dey.

The project was embraced by the Indian Ministry of Health and Family Welfare, who were the architects of the project, along with high-level officials at WHO and UNICEF who contributed great interest, input, and support. Beyond this cooperation, **rolling out the project also required collaboration between staff focusing on polio eradication, RI, nutrition, and sanitation**—including staff found within different ministries in the Indian government. One participant considered this a positive because it, “satisfied a lot of people’s belief that polio should be a convergent program.” Still, some interviewees said it was not always easy to coordinate so many different agencies in so many different districts. Differences of opinion existed over whether the comparatively well-funded polio eradication program should kick in funding for, as an example, water and sanitation projects. One respondent called this a **“push-pull collaboration” that was ultimately worth it.**

Government ownership of the 107 Block Plan was never in question. Many of the communications activities, however, were taken on by UNICEF staff at the ground level, raising questions of long-term sustainability. **Efforts**

are now underway to expand these convergent approaches to government staff at the community level—ASHAs and anganwadi workers.

The potential to roll out 107-Block-Plan like programs in other polio endemic areas should be given serious consideration. However, international officials familiar with the program caution that its success was to a large degree dependent on a “very robust” polio program, as well as government support for programs like RI. For example, in Bihar, the 107 Block Plan coincided with the Muskaan program, an initiative founded upon renewed interest in RI at the state level and, according to one interviewee, in part because of concerns that polio eradication activities were distracting from RI. Another respondent said the recent, striking increase in RI coverage in Bihar was “amplified and supported by” the 107 Block Plan, but certainly not a result of the plan alone.

While the 107 Block Plan was not implemented in isolation, it is probably not a coincidence that India saw its last polio case only a few years after its inception. Overall, the 107 Block Plan represents a **clear and inspiring example of how polio eradication can spearhead a project with broader impacts on RI and PHC**—impacts that then positively affect the polio program as well.

4.9 Worker Time Allocation

The Polio Eradication Workforce. Across all case studies, polio eradication campaigns required an extensive workforce to carry out the programs' planning and supervision, social mobilization, vaccination, and monitoring and evaluation activities. The types of workers and the extent of their involvement varied from case to case.

Polio Workers in Our Case Studies. In all case studies, WHO and UNICEF provided staff whose primary goal was to focus on polio eradication, though they carried out other activities as well. The numbers of these staff varied widely. For example, UNICEF staff permanently posted in our study districts ranged from extensive in the case of Purba Champaran, Bihar, India, to zero in the case of Rubavu, Rwanda.

When it came to carrying out polio campaigns, **all case studies used staff from other existing health programs or services.** For example, polio's social mobilization activities were carried out by community health workers in Rubavu, Rwanda, whose normal day-to-day responsibilities included raising communities' awareness of health issues and services. In addition, RI and PHC workers served in all case studies as polio vaccinators and/or supervisors, and political and health officials' planning experience and political weight was used to organize and carry out polio campaigns.

In addition, in all of the case studies, **the polio program has trained large groups of staff**, commonly referred to as volunteers, who often possess little to no knowledge of health beyond their work on polio campaigns, most extensively in Camucuio, Angola; SITE Town, Karachi, Pakistan; and Kumbotso, Kano, Nigeria. In fact, in Camucuio, Angola, the vast majority of workers carrying out polio campaign's on-the-ground implementation are students, teachers, merchants, farmers, and other community members.

Worker Time Allocation in Our Case Studies. The time workers spent on polio campaigns was, of course, linked directly to how often campaigns occur. **The table below depicts the average number of days frontline government health staff and non-health workers must dedicate to polio campaigns per year.** This is based on the number of days each campaign required for on-the-ground implementation (including pre- and post-activities), as well as the number of campaigns held per year.

Also included in this table are the types of workers assigned to these activities. Workers making up a larger proportion of the polio workforce are listed first.



Photo. Health worker in Nizamabad, India, providing antenatal care.

Case study	# of days polio campaigns per year*	Polio workers (frontline campaign activities only)
Purba Champaran, Bihar, India	77	Anganwadi workers; auxiliary nurse midwives; ASHAs; health officials (as supervisors), and volunteers** (as workers and supervisors)
SITE Town, Pakistan	55	Lady health workers; volunteers ; lady health visitors; other UC-level health staff; lady health supervisors and health staff (as supervisors)
Kumbotso, Nigeria	32	Community health workers; volunteers ; nurses; ward and focal persons (as supervisors)
Camucuio, Angola	9-24	Volunteers ; health workers; local leaders and health officials (as supervisors)
South Omo, Ethiopia	12	Health extension workers; volunteers (at the health post level); health officers, health extension worker supervisors, and nurses (at the health center level)
Nizamabad, Andhra Pradesh, India	10	Anganwadi workers; ASHAs; and volunteers
Rautahat, Nepal	8	Female community health volunteers; volunteers ; other health center staff including assistant health workers and auxiliary nurse midwives
Rubavu, Rwanda	3-5	Community health workers; nurses; volunteers ; district-level health officials (as supervisors)
<p>* Days are best estimates based on the information that was available; the amount of time dedicated to polio social mobilization activities was unknown for, and therefore, not included in some case studies. As not all activities performed for polio eradication are easily quantifiable, these numbers represent conservative estimates.</p> <p>** Volunteers were teachers, students, merchants, farmers, etc., who have no affiliation with the health sector outside of their work on polio campaigns. In some case studies, these were not true ‘volunteers,’ but people working for the per diem or assigned to work by their other jobs. In either case, their work on polio campaigns did not detract from health system work more generally, as they do not perform other services. (There were possible impacts on, for example, the education system, but such impacts were beyond the scope of this study.) Volunteers who routinely conducted social mobilization and/or other health-related services beyond their work on polio campaigns were considered health staff for our purposes and are not included in this group.</p>		

It should be noted that in addition to on-the-ground implementation (e.g. social mobilization, vaccination, and mop-up activities), extensive planning and oversight were necessary, which required additional time and dedication on the part of policy makers and health officials at the national and district levels.

Positive Effects on RI and PHC. **WHO and UNICEF staff supported by polio-specific funding provided support for RI and PHC services.** Some information on the nature of that support is provided in the sections on surveillance and community awareness; in addition, most staff also assisted with RI and PHC planning activities as opportunities arose. Consistent with the results of a survey of WHO staff in the AFRO region (74), WHO and UNICEF respondents across our case studies reported some involvement in RI and PHC activities even when their primary mandate was polio eradication.

Negative Effects on RI and PHC. **The time devoted by government workers to polio campaigns dwarfed the time devoted by WHO and UNICEF polio staff to other health services in every case study, simply because of the vastly larger numbers of government staff.** For example, in Nepal, 60 WHO staff and 14 UNICEF staff (many of whom are funded by the polio program) provide some support for RI and PHC activities. However, this is far outweighed by the time spent by government health workers on polio campaigns in our case studies. In Nepal, over 92,000 government workers contribute time to polio eradication. Thus we conclude that, **across our case studies, polio eradication reduced overall worker time available for RI and PHC activities.**

It is impossible to ascertain what health-related staff would have done with their time should polio campaigns not have required their commitment. It is likely, however, that at least some portion of the days spent on polio and listed in the chart above would have been dedicated to provision of other health services.



Nevertheless, it is possible to evaluate how health staffs' time away from their normal duties during polio campaigns directly affected RI and PHC services provided at health posts; this issue is discussed in the Service Interruption section of the report.

Missed Opportunities surrounding Workers' Time. As can be seen in the table above, many skilled and knowledgeable health workers are involved in polio campaigns. These same workers are often involved in other campaigns and outreach activities beyond polio, and beyond their normal routine activities. In fact, in Purba Champaran, Bihar, India, health officials and workers complained about back-to-back campaigns (polio, measles, and vitamin A), all of which targeted much the same population and used much of the same workforce.

Duplicated efforts such as these were an inefficient use of both workers' time and energy and of funding. Some case studies were already taking a hard look at this issue. For

instance, the Rwandan Health Sector Strategic Plan 2009-2012 calls for expanded integration of community health care packages that strengthen integrated management of antenatal care and childhood illnesses (75). Polio campaigns could provide a backbone for integrated outreach in such plans.

Barriers to Seizing Opportunities. Multi-antigen campaigns are not easy to implement. Polio is the only vaccine that can be given orally (and therefore does not require trained health workers to administer), so polio campaign workers may not be able to administer injectable vaccines. Further, as there are often different age groups targeted for different antigens, confusion and mistakes are possible. In the long run, better functioning RI is a better solution for immunization than better integrated SIAs.

That said, Vitamin A has been integrated into polio campaigns in many countries with success, and research shows the delivering other interventions such as bednets during vaccination campaigns can be successful (76). Overall, campaigns in many of our case studies missed opportunities for better integration.

Recommendations involving Workers' Time. It is imperative that health officials and program administrators **conduct cross-planning sessions to determine if and how programs and services—especially campaigns—can be better integrated** to reduce obligations on the workforce, without compromising on programs' underlying objectives. Such planning should take place at high levels as well as the local level.

At a minimum, **more extensive modeling should be considered that focuses polio campaigns only where and when they are necessary.** This is of course more of a concern for those areas that utilize a large percentage of the health workforce for supplementary activities several times per year.



INTEGRATED CAMPAIGNS

Nigeria's Immunization Plus Days

In 2006, as part of an attempt to improve public acceptance of polio vaccinations, Nigeria began implementing Immunization Plus Days (IPDs) in place of standard polio campaigns.

While the exact interventions vary by state, a number of health interventions were recommended for inclusion. National recommendations suggested that OPV and vitamin A be given house-to-house, while fixed points at health facilities offer oral polio drops, diphtheria pertussis and tetanus (DPT), hepatitis B, yellow fever, tetanus toxoid, and measles vaccines, as well as child survival interventions such as vitamin A, anti-helminthics, oral rehydration salts, and insecticide-treated bed nets.

Further, it was recommended that “special teams” give out incentives such as soap, sweets, and milk satchels along with oral polio drops and vitamin A.

Integrated campaigns provide a number of clear advantages over single disease campaigns:

- In cases where door-to-door campaign visits are the only contact a child has with the health system, providing additional interventions beyond polio vaccine alone is a powerful way to provide essential services to children that would otherwise remain unreached.
- Integrated campaigns, like IPDs, relieve staff of the need to leave their regular jobs on multiple occasions for repeated campaigns. The inclusion of vitamin A with polio was a fairly simple step that was practiced in many—though not all—of our case studies.
- Because training for IPDs necessarily includes information on other health issues, it broadens staff knowledge beyond polio.



An Immunization Plus Day in Kano, Nigeria

The potential and limitations of IPDs as a strategy were highlighted by workers from Kumbotso when they described their interactions with community members during campaigns.

Some health officials and workers in Kumbotso stated that community members largely regarded the other incentives (such as sweets, soap, and wheat seeds) as “gifts” and reported that these gifts did increase communities’ acceptance of polio drops. “We also provided gifts to the children and mothers,” one supervisor reported. “I was surprised because they called us to ask why we did not go to their place. On seeing our vehicle, they all brought out their children for immunization.”

Others reported a more reluctant acceptance on the part of the public: “Most people are forced to collect the vaccines

unwillingly. Some take the vaccines because of the meager incentives given to them.” Some respondents even recounted clear examples of continuing public defiance: “An incidence occurred when I gave a vaccinated child a whistle, his mother threw away the whistle. Then, she just fell down as if something was done to her. As a result, the whole community thought that we gave her a poison. Thank God, the district head intervened.”

As this example from Kumbotso illustrates, IPDs do not automatically alleviate community concerns, and cannot provide a replacement for real PHC services. Still, the power of IPDs to provide additional services was considerable, and wider use of IPDs in more countries, following the Nigerian example, would be beneficial.

4.10 Service Interruption

Service Interruption and Health Systems. **Polio campaigns were one of many factors that interrupted services in our case studies**—strikes, corruption, mismanagement, other campaigns, and workers simply not showing up were other factors that caused service interruption outside of campaign days in primary health centers in many of our case studies.

One official from the SITE Town, Pakistan case study said, “We can look at the times when there are no campaigns... in that time, RI and PHC had problems, too. What actions were not done? And this is an example of the problems on a larger scale... People are not doing their jobs. Management is the problem.”

The concern of this official—that polio campaigns may be used as a scapegoat by workers who are simply not doing their jobs—is valid. That said, given the amount of worker time devoted to polio eradication, as described in the previous section, attention to how campaign activities may interrupt specific services is important.

Service Interruption in Our Case Studies. Because the factors underlying service interruption are so complex and context-specific, it is worth addressing each case study separately. Across the case studies, **during campaigns, no case study was entirely free of service interruption. Neither were services in any case study entirely shut down.**

In each case study, we directly observed PHC services being provided both during and outside of campaign days. Our analysis of service interruption here is primarily based on that direct observation, supplemented by interview data. In many case studies, we were also able to obtain data from health post logs on how many patients were seen per day before, during, and after campaigns for RI and other health services. In other cases, health post log data proved difficult to access.

Rautahat, Nepal. Campaigns take place on Saturdays and Sundays. Since health posts are always closed on Saturdays, there was no service interruption on that day. On campaign Sundays, RI and PHC services were sometimes abandoned due to lack of staff. This was particularly true for sub-health posts. However, consistency of service provision at some sub-health posts outside of campaign days was often poor. Therefore, in these cases, the fact that on campaign days workers showed up to obtain vaccines and then were available by mobile phone might actually constitute an improvement.

Logs at health posts were poorly kept, and so they were an unreliable data source. That said, some service slowdown was reflected in the logs on the campaign Sunday in 3 of the 10 health posts for which logs were reviewed.

Purba Champaran, Bihar, India. Campaigns take place over six days. During those six days, no PHC services or health-post-based RI services were interrupted, as staff were carefully reassigned to avoid service interruption. Services provided by field-based auxiliary nurse midwives, including field RI sessions, were interrupted, but all RI sessions were rescheduled. Anganwadi childcare and child nutrition services were provided by a 'helper' during the campaign rather than by the anganwadi worker herself, but were not interrupted.

A formal review of patient logs in Purba Champaran was not possible. In looking over the log books more informally during participant observation visits to health posts, no service interruption was apparent.

Nizamabad, Andhra Pradesh, India. Some workers were not available because of campaign involvement, but due to careful planning, their responsibilities were taken care of by others. Patients in need of the Medical Officer were required to travel to the higher facility with help of ambulance services (as we did not observe this happening, we cannot comment on the frequency with which it occurs).

No service interruption during campaigns was apparent in the formal review of health post patient log books.

SITE Town, Karachi, Pakistan. In SITE Town, service interruption as a result of polio campaigns was limited to dispensaries and independent centers / complexes; hospitals maintained standard RI and PHC service provision without pause. Respondents from three dispensaries maintained that, particularly in the case of RI, services are canceled during the polio campaigns. One of these facilities had plans and staff in place to administer RI immediately prior to and following campaign days to compensate for any service interruption. The two other dispensaries reported no such plans. However, not all dispensaries reported an interruption in activities. Two respondents from a different facility maintained that RI services continued, though the staff may be busier due to personnel shortages on account of the campaign. No information was gathered on the staff size or management of these dispensaries, so the study was unable to speculate on why one facility seemed largely unaffected by the campaigns, while services in others were closed.

Researchers were not permitted to access the patient logs, but did collect data through their site-visit observations on the number of patients served and for what purposes. This data, however, was not sufficient enough to draw any conclusions.

Rubavu, Rwanda. No service interruption observed or reported in the case study district; however some national-level officials did state that instances do occur. A number of strategies for avoiding service interruption were present, including assigning staff to campaigns on what would normally be their days off; reallocating staff to cover all services; and covering services with fewer staff than usual.

Health post log data revealed no service interruption; in fact, awareness activities for HIV testing were taking place in the district starting the week before and continuing during the week of the campaign. Even in the days of the campaign, centers experienced significant increases in HIV testing (one center seeing 376 patients for this service alone on the second day of the polio campaign), but were able to accommodate all patients despite the polio campaign and HIV awareness activities occurring simultaneously.

Kumbotso, Kano, Nigeria. RI and PHC services were often, to some extent, interrupted at the health centers during polio campaigns. RI workers were sometimes reportedly abandoning their posts even when they were not assigned to work on the campaigns (simply because they could get away with it) and PHC service interruptions were reported at some health posts.

Health post log data revealed no obvious service interruption. However, complete log data was only accessed from two health facilities and partial data from one health facility, so this should not be considered a conclusive result.

South Omo, SNNP, Ethiopia. Health centers remained open during polio activities; but there was an emphasis on emergency services during campaigns, so that other routine activities gave way to campaign activities. Health posts at the sub-health center level typically closed during campaigns, particularly in areas with only one health extension worker.



Appointments were rescheduled. It should be kept in mind that while service interruption occurs here, there are very few campaign days per year, so the overall impact may not be great.

No health post log data was collected in South Omo.

Camucuio, Angola. The vast majority of respondents agreed that PHC and RI activities were not interrupted during polio campaigns. To avoid any service interruptions, professional health staff stated that they devoted time to the polio campaigns only when their routine activities were slow or on days they were not scheduled to work. Also, because polio workers in Camucuio were comprised predominately of volunteers (meaning these workers had no affiliation with the health system) their involvement in polio campaigns had no effect on the provision of health services. However, polio campaigns stretch Friday through Sunday and a few respondents did state that RI activities were sometimes affected on the first day of a campaign.

No health post log data was collected in Camucuio.

Missed Opportunities involving Service Interruption. **Serious campaign-related service interruption was most likely to occur in health systems that were already weak**—when worker accountability was already limited, and planning was not always strong. Given generally weak provision of health services, it is little surprise that **these same areas are likely to be polio-endemic**. Our two case studies with consistent and ongoing polio transmission—SITE Town, Pakistan and Kumbotso, Nigeria—were also the ones that showed evidence of campaign-related service interruption.

There is a major opportunity for polio eradication here. The same areas where polio eradication had the most extensive infrastructure, and the most potential for significant positive impact, were also the areas where its negative effects may be more severe. Building on the infrastructure that exists to ensure a positive legacy is important if polio eradication aims to do no harm in these areas.

Recommendations surrounding Service Interruption. **Careful planning can mitigate the most serious effects of service interruption.** Take for example the case study of Purba Champaran, Bihar, which possessed more than 70 campaign days per year. There, staff were carefully reallocated to minimize, insofar as possible, the service interruptions caused by campaigns. Such careful planning cannot eliminate service interruption entirely—fewer workers were still available—but it can largely mitigate the more severe effects.

DISCUSSION

Our quantitative analyses established several statistically significant correlations relating polio eradication campaigns to RI and maternal health care indicators. However, the effects we observed were generally small relative to confidence intervals, and data and design constraints limited our ability to attribute causality to polio vaccination campaigns. Therefore, we consider the results of our quantitative analysis inconclusive. To the degree that polio eradication campaigns have an effect on outcomes in RI and maternal health care, these effects are small relative to other factors, and inconsistent from place to place.

This finding reinforces the qualitative conclusions that effects of polio eradication campaigns were mixed, and that opportunities to systematically strengthen health systems in polio-endemic areas often remained missed. Polio eradication's surveillance, communications, and service delivery systems were all unmatched in terms of combining quality with reach. In areas with few campaigns per year and with dedicated national governments to build on these systems—as in Rubavu, Rwanda and South Omo, Ethiopia—polio eradication delivered its most unambiguously positive impacts.

But most case studies showed more mixed effects. In areas with frequent campaigns, where provision of other health services was weak, community members and health staff were involved in increasingly heavily-supervised, well-funded, and repeated polio eradication campaigns, even as basic services remained underfunded and sometimes unprovided. Not coincidentally, SITE Town, Pakistan and Kumbotso, Nigeria, the case study districts with ongoing polio transmission, were also home to violent unrest, high levels of poverty, tensions between minority populations and governments, and underresourced health systems. Polio eradication did not create the poor health services in these areas, but it also did little to change the situation.

The argument that polio eradication activities would lead to support for RI thus proved true in some cases but is not a self-fulfilling prophecy. It requires concerted effort. Ideally, health system strengthening would have been built into the program from the beginning. Understandably, international and national polio eradication staff have concentrated on the eradication of polio in its most intractable strongholds. Yet greater attention to health system impacts could potentially increase baseline RI coverage, help alleviate public distrust, and increase worker motivation—all critical factors for eradicating polio as well for as achieving other health goals.

Inspiring best practices profiled in the In Focus sections show that health systems strengthening and polio eradication can be synergistic efforts. Scaling up these best practices—expanding and integrating the considerable surveillance, supervisory, and communication capabilities of polio eradication to encompass other health issues beyond polio—could create a legacy even more significant than the eradication of polio itself.

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DEFINITIONS OF CATEGORIES IN TABLE 1

Was there strong evidence that polio eradication efforts directly increased **public awareness** of other health issues or services?

Yes: A connection between polio campaigns and increased public awareness of other health issues/services was explicitly made by respondents. Rather than just generally saying that awareness increased due to polio, respondents noted improved awareness relating to a specific issue (such as routine immunization) or a concrete situation (such as Immunization Plus Days) in which additional information was provided as part of polio social mobilization.

No: No concrete connections between polio campaigns and increased public awareness of other health issues/services were described by respondents or found in document review. Though polio campaigns could potentially have contributed to increases in awareness, we did not find concrete examples in which this connection could be traced.

Did the AFP **surveillance** system provide significant support of surveillance of other diseases?

Integrated: 1) The WHO-managed AFP surveillance system includes integrated surveillance of other diseases / health issues (using the same forms and reporting systems); OR, 2) AFP surveillance falls under the Government-run disease surveillance system (along with other diseases) and is not independently managed by WHO.

Significant Support: The WHO-managed AFP surveillance system supports monitoring of other diseases beyond AFP, but this system is not fully integrated (meaning, for example, that duplicated efforts may occur).

Limited Support: 1) Polio workers are trained on and instructed to report suspected cases of other diseases beyond AFP, but workers report these cases to other government-run surveillance systems that are operated outside of the WHO-managed AFP surveillance system; and/or 2) standards from the WHO-managed AFP system were used to develop more robust protocols / procedures for other disease surveillance systems, but AFP surveillance remains separate from other disease surveillance.

Did polio outreach measures directly contribute to the **provision of additional health services** to remote or marginalized populations?

Yes: There are concrete examples of polio outreach measures leading to the provision of additional health services to remote/marginalized populations. For example, maps of or information about remote/marginalized populations were used for other work with these groups.

During campaigns: Additional interventions such as Vitamin A reached marginalized populations during polio campaigns only. No clear and direct evidence of broader contributions to outreach.

No: Respondents and documents did not provide concrete examples of polio outreach measures leading to the provision of additional health services to remote/marginalized populations.

Was there evidence that polio contributed to the **cold chain**?

Yes: Respondents and/or documents provided concrete examples in which polio eradication efforts directly contributed to the development and functioning of the cold chain.

No: Respondents could not provide concrete examples of polio contributions to the cold chain.

Was there strong evidence that polio training enhanced health workers' knowledge in other areas?

Yes: *Polio training enhances and/or reinforces health workers' knowledge in areas outside of the scope of polio activities.*

No: *No evidence that polio training enhances and/or reinforces health workers' knowledge beyond what is needed to administer basic polio eradication campaigns. There may be some broader uses for skills learned for polio eradication (e.g. monitoring the cold chain, disease surveillance, etc), but trainings have not made other direct contributions to wider worker knowledge.*

Was there evidence polio increased supervision of other health services at the district level?

Yes: *Respondents provided concrete examples of polio activities making contributions to increased supervision of and/or high-level attention to other health services at the district level.*

No: *Respondents and documents did not provide concrete examples of polio contributing to supervision of or high-level attention to other health services at the district level.*

Was there current reports of community dissatisfaction over the focus on polio?

Yes: *Respondents provided specific examples of community members voicing frustrations (or community members themselves recounted their own frustrations) about the health system's level of attention provided to polio eradication campaigns. Note: dissatisfaction with inadequacy of other services does not necessarily equal dissatisfaction with focus on polio.*

No: *No explicit examples of community dissatisfaction could be directly linked to the level of attention local health systems pay to polio eradication.*

Did some workers express dissatisfaction over the focus on polio?

Yes: *Ground-level workers that we interviewed voiced dissatisfaction with the frequency and/or level of attention provided to polio.*

No: *Ground-level workers that we interviewed did not voice dissatisfaction with the frequency and/or level of attention provided to polio campaigns.*

Was there evidence that polio distracted high-level attention from other health issues?

Yes: *Respondents and/or documents, especially respondents at high levels, mentioned that the attention provided by high-level officials and/or commitment by the government to polio reduced time and commitment to other health issues.*

No: *Respondents made no explicit mention of greater attention given to polio distracting high-level attention from other health services.*

Approximate number of days frontline health staff spend on campaigns per year (**worker time allocation**)

Days are best estimates based on the information that was available; the amount of time dedicated to polio social mobilization activities was unknown for, and therefore, not included in some case studies. As not all activities performed for polio eradication are easily quantifiable, these numbers represent conservative estimates.

Total **service interruption** impact (considers extent of interruption and number of days)

To describe the overall impact of service interruption, we considered both (1) the number of campaign days per year AND (2) the extent of service interruption during campaign days.

Minimal: (1) Fewer than 20 campaign days per year, AND (2) only slight service interruption during campaign days (i.e., health posts not significantly more likely to be closed on campaign days than on other days, and all or nearly all services being provided at health posts during campaigns)

Moderate: One (but not both) of the following are true: (1) More than 20 campaign days per year; OR (2) campaign-related service interruption observed or reported, such as some closed health posts or severely understaffed health posts.

Substantial: Both of the following are true: (1) More than 20 campaign days per year; AND (2) campaign-related service interruption observed or reported, such as some closed health posts or severely understaffed health posts.