Impact of Measles Eradication Activities on Routine Immunization Services and Health Systems in Bangladesh

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Background. Seroprevalence studies suggest that vaccination coverage of 90%–95% is needed to eliminate measles. In Bangladesh, routine measles vaccination coverage rates have recently reached 80%–85%. The Government of Bangladesh implemented catch-up vaccination through supplementary immunization activities (SIAs). The aim of the present study was to understand the impact of SIAs on immunization services and the health system.

Methods. The study was conducted at 4 sites, all of which had relatively low routine vaccination coverage rates. A document review was performed, followed by interviews of key personnel selected by purposive and snowball sampling. A staff profiling survey was also undertaken.

Results. Despite overall high levels of immunization, the expanded program on immunization for measles has not reached the coverage levels targeted by the Government of Bangladesh. The first SIAs vaccinated 35 million children, and the second targeted an additional 20 million. According to data and respondents, implementation of the SIAs was successful with sufficient funds being available, although timely disbursement of funds was inadequate in some areas. Staff were well motivated, and additional training helped boost a positive approach to vaccination.

Conclusions. The SIAs had a positive impact on health and immunization systems and have created a framework on which other health care interventions for bacterial and viral diseases could be based.

Measles remains one of the leading causes of death among young children, with 164,000 children dying worldwide in 2008 and 95% of all measles-related deaths occurring in low-income countries with weak health infrastructures [1]. A measles vaccine has been available for many years, but seroprevalence studies suggest that coverage of 90%–95% is needed to eliminate the disease. Targeted vaccination programs during 2000–2008 in high-risk countries involved the vaccination of ~700 million children aged 9 months through 14 years.

During this same period, global measles mortality decreased by 78% [1]. In recent years in Bangladesh, the national figure for routine measles vaccination coverage rates was 80%–85%. Routine measles vaccination coverage is measured at 12 months in Bangladesh. However, ~15% of vaccinated children do not develop immunity, because the vaccine efficacy when given at 9 months is only 85% [2]. Accordingly, 25%–30% of children in each birth cohort remain susceptible to measles [3].

Countries that offer only 1 dose of measles vaccine through the expanded program on immunization (EPI) continue to experience frequent measles outbreaks, whereas countries providing 2 doses have experienced a decrease in the number of cases and an even greater decrease in the number of deaths, presumably because of the development of herd immunity [4, 5]. The World Health Organization–United Nations Children’s Fund (UNICEF) comprehensive strategy for measles elimination and reduction of measles mortality aims to (1) achieve and maintain high coverage (>90%) of the first
dose of measles-containing vaccine (MCV1) among all children by the age of 12 months through routine immunization programs, (2) ensure that all children receive a second opportunity for measles vaccination, (3) implement effective laboratory-supported disease surveillance, and (4) provide appropriate clinical management for measles cases [2]. The Government of Bangladesh (GoB) implemented second-dose vaccination through nationwide catch-up and follow-up supplementary immunization activities (SIAs) [4]; the first catch-up SIAs were undertaken during 2005–2006, and the follow-up SIAs were completed in February 2010.

Distribution of public health care services in Bangladesh follows a uniform pattern of administrative tiers: national (mostly based in Dhaka), regional (6 divisions), district (64), upazila (482), union (4498), and ward (13,494). The constitution of Bangladesh mandates basic health care services for all citizens as one of the fundamental responsibilities of the state. Toward this goal, the GoB has made efforts to extend health services to the entire population through its Health, Nutrition, and Population Sector Program (HNPSP). In 2006, health expenditure in Bangladesh per capita was US$12, of which US$4 was financed by the GoB. Health Management Information System data are collected by the public health facilities at the district level and below, and the information is disseminated nationwide through the annual Health Bulletin. Immunization services were originally made available through the EPI in 1979.

The potential impact of measles eradication activities on routine immunization services and the greater health exemplifies the long-standing debate around vertical versus systemic approach to service delivery [6–11], particularly because of the targeted and time-limited nature of eradication goals and resource constraints. The aim of the present study was to assess the impact of measles elimination activities on immunization services and the health system in Bangladesh.

**METHOD**

The study was designed around a previously tested toolkit for assessing measles eradication impact on health systems [12]. Participants, enrolled on a voluntary basis, gave written informed consent before being interviewed.

**STUDY SITES**

The study was conducted in the rural district of Sunamganj; 2 upazilas, Dearai, and Jamalganj; and the Dhaka City Corporation (DCC). All of these regions had relatively low routine vaccination coverage rates. In terms of the DCC, 2 low performing zones (zones 5 and 7) were purposively selected in which both DCC and nongovernmental organization (NGO) staff members were interviewed.

**DOCUMENT REVIEW**

An initial review was performed of published qualitative, quantitative, and analytical data, as listed in Table 1. Data were compiled to provide a comprehensive understanding of the health system, immunization and measles services, and past and current measles SIA activities.

**KEY RESPONDENT INTERVIEWS**

The study used 2 sampling methods for selecting interviewees.

**Purposive Sampling**

Selection was based on professional characteristics in terms of both role and experience on a range of issues relevant to the research questions to interview as diverse a range of individuals as possible.

**Snowball Sampling**

Interviewees were asked to nominate others who might be willing to participate in the study.

A total of 60 respondents with a wide range of responsibilities and positions from each health care level were interviewed (Table 2). Qualitative analysis began after initial field data collection, which led to refinements as the study progressed. The interviewers wrote transcripts on the same day of the interviews, and transcripts were reviewed with the field team daily to discuss the results of their sessions and/or interviews and to determine best practice for further sessions and/or interviews. Analysis followed a sequence of interrelated steps that included reading,
Table 2. Respondents’ Organizational Affiliation

<table>
<thead>
<tr>
<th>Organizational affiliation</th>
<th>National level</th>
<th>District 1 (urban)</th>
<th>District 2 (rural)</th>
</tr>
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<tbody>
<tr>
<td>Government:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Policy makers</td>
<td>16</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>District level managers</td>
<td>-</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Service level managers</td>
<td>-</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Service level staff</td>
<td>-</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>NGOs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District level managers</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Service level staff</td>
<td>-</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>International Organization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy level</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>District level managers</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>21</td>
<td>16</td>
<td>23</td>
</tr>
</tbody>
</table>

coding, displaying, reducing, and interpreting. The data-display and reduction processes were conducted after all data had been collected to formalize the information into themes. Each theme was then examined separately using the available data.

STAFF PROFILING SURVEY

A staff profiling survey was performed in the rural district of Sunamganj and in the DCC. A standard questionnaire was given to 60 health care workers who had direct experience in measles-related activities. The randomly selected respondents were health assistants, family welfare assistants, and vaccinators. The questionnaire was self-administered and designed to capture basic characteristics and roles of the staff, training experience, work load, and income, with focus on the changes or differences that may have occurred in relation to measles SIAs. Quantitative data were entered into the SPSS program (SPSS version 11.5). Univariate analysis was performed separately to explore each of the selected variables in a data set, assess the range of values, and describe the pattern of responses to the questions.

RESULTS

Health and Immunization Service Delivery

Under the HNPSP, the EPI is one of several programs of the Essential Services Delivery department that is administrated by the Director of Primary Health Care and the Essential Services Delivery Line Director. Cold chain, logistics, training, surveillance, and communication are the responsibilities of the various Line Directors responsible for each of the respective sector areas (Figure 1). There is effective coordination and collaboration with other Line Directors to ensure an effective immunization program [21].

The EPI in Bangladesh was inaugurated in 1979, but national vaccination coverage remained <2% until 1985. Committing to the Global Universal Child Immunization Initiative, the GoB began a phase-wise process of EPI intensification during 1985–1990 with the aim of vaccinating all infants against 6 vaccine-preventable diseases, including measles. During that time, routine immunization services were extended throughout the country to all rural and urban areas on the basis of the Primary Health Care service delivery infrastructure.

The current immunization strategy is based on a model of 8 outreach sites per ward, with 2 vaccination sessions held each week. Vaccinations are administered by health assistants with the help of family welfare assistants in rural areas who are appointed by the Ministry of Health and Family Welfare (MOHFW) at the village level [27]. Vaccination services in urban areas are provided through a public-private partnership. Although the City Corporations (CCs) and the municipal governments are responsible for providing EPI services, 95% of vaccinations are performed by national NGOs, with the remaining 5% being delivered by CCs and municipalities. The CCs assist NGOs in planning, monitoring, and evaluation. As with rural areas, vaccines are mainly provided in this service delivery system through outreach sites (EPI centers) in urban areas; no vaccinations are administered at home [28].

Since January 2009, the full course of child vaccinations in Bangladesh has consisted of 3 doses of pentavalent vaccine (diphtheria, pertussis, tetanus, hepatitis B, and Haemophilus influenza type b), 4 doses of oral polio vaccine, 1 dose of Bacille Calmette-Guérin vaccine against tuberculosis, and 1 dose of measles vaccine [29].

The EPI has been a huge success in Bangladesh over the past 20 years, with large increases in vaccination coverage rates for all vaccines involved in the program (Figure 2).

The Measles Control Action Plan (MCAP), during 2004–2010, aimed to achieve a national first-dose coverage >90% by 2010, but this remains unlikely considering only 83% coverage in 2009. In addition to strengthening routine EPI, the MOHFW organized measles catch–up SIAs for all children aged 9 months through 9 years. Phase 1 of the SIAs was in September 2005, with an estimated 1.37 million children being vaccinated. In the second phase, in February 2006, support was received from the Measles Initiative (American Red Cross, United Nations Foundation, World Health Organization, UNICEF, and the Centers for Disease Control and Preventions), allowing for ~33.5 million children to be vaccinated, giving a catch-up coverage of 93% (Table 3) [27].

Measles campaigns and other activities for its elimination are already part of the health strategy of Bangladesh. On the basis of the MCAP, surveillance has been expanded to measles, including comprehensive outbreak research and case management. Planning and implementation of the EPI and SIAs is performed by the National Committee of Immunization Practice, headed by the Secretary of Health. An Interagency Coordination Committee (ICC) plays an important role in maintaining active collaboration for the EPI and SIA programs. At district level, the EPI activities are fully integrated in other programs under the
The responsibility of the Civil Surgeon who is assisted by an EPI unit, which provides all necessary support for the upazilas of each district.

At the grassroots level, one of the key results from a service delivery perspective was the increased faith that local persons now have in terms of vaccination and health care worker representation after the SIA program, because families have already seen the benefit of vaccinating against measles: "Following the SIAs, they saw results...which eventually increased their faith in us."

**Financing**

In terms of financing, the EPI is one of the largest recipients of national and international funding allowing the program to be flexible and sustainable. In 2006, the total spent on health in Bangladesh accounted for 3.2% of the gross domestic product, with a per capita health expenditure of US$12, of which US$4 was financed by the GoB. The GoB plans to continue to spend more money from its own funds and gradually reduce funding from other sources for its EPI and SIA programs, because they have increased their percentage of total health expenditure from

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**Figure 1.** Organogram of EPI program. MOHFW: Ministry of Health and Family Welfare; MOLGRD, Ministry of Local Development, Rural Development and Co-operatives; NGO, nongovernment organization.

**Figure 2.** Trend in valid vaccination coverage, 1991–2009.
26.5% in 2000 to 31.8% in 2006 [30]. At present, funds are given to UNICEF to buy and import vaccines and support equipment through its own procurement and cold chain procedures. Respondents felt that the success of the measles SIAs may help in attracting funds for other health system interventions, and the incentives received by SIA staff members provided commitment to health system responsibilities.

In terms of impact on financing at the grassroots level, respondents commented that “money is not the main problem...” adding that there was no negative impact on immunization programs or health systems in terms of allocating funds to the implementation of SIAs. However, adverse effects were identified because of delays in disbursing funds to some districts, resulting in some field workers having to pay for certain costs out of their own pockets, which is a problem, considering that many field workers are low paid.

**Information Systems**

The EPI’s monitoring system is well established, with all EPI activities and SIA being reported in the field, compiled at rural and urban level, and transmitted to national level through the Management Information System of the Directorate General of Health Services (DGHS). Surveillance activities are still rather disintegrated, with different divisions of the DGHS performing surveillance activities on different issues, as seen with all vaccine-preventable disease data being collected by the EPI, whereas data on communicable diseases, such as malaria, hepatitis, and tuberculosis, are collected by the Institute of Epidemiology, Disease Control, and Research. However, under a new public health laboratory system, a national reference laboratory at the Institute of Public Health has been established for polio and measles.

According to the majority of key informants, measles SIAs had a direct impact on future measles surveillance and laboratory support, with EPI field and laboratory staff having better surveillance skills after SIAs, allowing for better understanding and management of case-based surveillance. After the first SIA, most suspected measles cases were investigated and diagnosed as rubella cases; however, after case-based surveillance began functioning, measles incidence rates decreased greatly: “In 2009, 144 outbreaks were investigated, but after laboratory confirmation none of them were identified as measles, rather all the cases were rubella.” Most respondents reported that measles SIAs helped reduce disease burden by helping Bangladesh “to move from a control stage to elimination stage.”

**Governance**

Key respondents at the national level attributed the successful implementation of the measles SIAs to the participation of different sectors of government. Although the MOHEW leads the SIAs at a central level, other ministries, such as the Ministry of Education, the Ministry of Local Government and Rural Development Division (MoLGRD), Ministry of Defense, Ministry of Religion, Ministry of Social Welfare, and other non-governmental and private sector partners, such as Grameen Phone, television channels, and other media, have played substantial roles in making the SIAs successful. An interministerial coordination committee was formed, working together on preparatory activities to implementation phases. These initiatives helped strengthen interministerial coordination and collaboration, allowing greater support throughout the country for measles SIAs and immunization in general.

The success of SIAs has had an impact on health systems both locally and nationally, with collaborations paving the way for other health care initiatives and activities, according to the majority of respondents. The involvement of other ministries, such as the Ministry of Education, MOLGD, Ministry of Defense, Ministry of Religion, and Ministry of Social Welfare, together with nongovernmental and international stakeholders and private sector partners, such as Grameen Phone, different television channels, and other media, played substantial roles in the measles SIAs and in the implementation of other health care activities, such as those related to tuberculosis, reproductive health, and family planning program. The SIAs were also praised by respondents in helping to strengthen interministerial coordination and collaboration with other sectors that may pave the way for future collaborations that will further strengthen the health systems in general throughout Bangladesh.

**Human Resources**

The availability of skilled manpower with technical expertise to vaccinate is essential for SIAs. However, this was a substantial...
challenge, because the MOHFW did not have a sufficient number of qualified personnel, with a large number of vaccinator positions remaining vacant. Successful completion of the last SIAs was only made possible by involving skilled personnel from NGOs, hospitals, and medical colleges. Logistically, respondents at national and district levels commented that meetings were held in which potential problems were discussed and corrective measures put into place before SIA implementation. The planning and management of large scale measles SIAs may have helped train staff for future mass projects.

The staff profiling survey showed that all staff members in the rural areas were health assistants and family welfare assistants, whereas staff members in urban areas were from different groups, such as vaccinators, paramedics, and staff nurses. Approximately 90% of the respondents had 10–14 years of education. More than two-thirds of the respondents in rural areas and 80% in urban areas had been working in the health sector for >15 years, and all respondents in rural areas and 70% in urban areas had >10 years working experience with immunization services. With few exceptions, the staff members of both rural and urban areas received in-service training on measles, vaccination, and health services. Both groups had an increase in workload during the SIAs, with most being involved in organizing vaccination centers, promoting vaccination, educating about measles, report preparation, and defaulter tracing (Table 4).

Furthermore, >85% of all staff considered the management and support of SIAs to be good or excellent before, during, and after SIAs, with all respondents reporting job satisfaction to be excellent or good for the same periods.

**Negative Findings**

Some negative aspects were identified. For example, in some rural areas, there is still a lack of refrigerators and cold boxes, a problem compounded by inadequate power supplies. One respondent from Sunamgonj commented that, “we managed that problem by purchasing ice from a local ice-cream factory.” In addition, some respondents in the field also reported inadequate stationery supplies, such as reporting forms, tally sheets, markers, cotton, and scissors. These items were purchased at their own expense and were never reimbursed.

**DISCUSSION**

The establishment of the HNPSP and incorporation of the EPI with a 1-dose measles vaccination program supplemented by catch-up SIAs have a positive impact on measles immunization and on the health system of Bangladesh.

EPI integration within the health system and integration of measles campaign activities into the EPI of Bangladesh are shown graphically in Table 5. In terms of EPI integration into the health care system, only the logistics arm remains separate from the rest of the health care system, as seen with the cold chain and vaccine import and transportation systems performed by UNICEF. Further financing and information systems are less then fully integrated into the health care system; however, there is cross-over of some areas. The measles campaigns are almost fully integrated into the routine EPI, with the exception of coordination, which receives extra support through the NCI.

There was a high level of political commitment to the measles SIAs, which is typical in Bangladesh, where government bodies come together in support of child health interventions. Positive impact of the first SIAs included increasing measles vaccination coverage rates, reducing the frequency and size of measles outbreaks, reducing the overall disease burden, creating positive attitudes among mothers toward service providers, improving providers’ skills, generating funds, and establishing a case-based surveillance system for measles throughout Bangladesh.

The findings revealed that involvement and support of both national and international development partners have been instrumental in the success of the EPI and measles SIAs and general improvements in the health care system.

The collaboration between the NCI and ICC, as well as the MCAP, has been notable in guiding the successful implementation of the EPI and SIAs in Bangladesh. Observation and study respondent testimonies highlighted the democratic decision-making processes that have taken place and the balanced representation of stakeholders in the ICC leading to the increased levels of vaccination coverage in general through its comprehensive Multi Year Plan, which provides a framework to plan activities within the national immunization program.

Although participants were generally positive regarding the impact that measles SIAs had on routine immunization and on the health system of Bangladesh, some concerns remain. An inadequate number of skilled health care professionals in the MOHFW led to additional staff being sought from the NGO and private sector. In addition, despite sufficient funding being available, disbursement of funds in a timely manner appears to require attention. Vacant positions should be filled before initiating further large-scale campaigns, and specific training of

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**Table 4. Measles Activities of Staff**

<table>
<thead>
<tr>
<th>Responsibilities (Multiple responses)</th>
<th>Percentage District (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dhaka (n=30)</td>
</tr>
<tr>
<td>Organizing vaccination centre</td>
<td>100</td>
</tr>
<tr>
<td>Promoting vaccines</td>
<td>90.0</td>
</tr>
<tr>
<td>Raising awareness in people about measles</td>
<td>33.3</td>
</tr>
<tr>
<td>Report preparation</td>
<td>26.7</td>
</tr>
<tr>
<td>Defaulter tracing</td>
<td>26.7</td>
</tr>
<tr>
<td>Searching for measles cases</td>
<td>10.0</td>
</tr>
<tr>
<td>Supervising measles SIAs at ward level</td>
<td>10.0</td>
</tr>
<tr>
<td>Providing vitamin A capsules</td>
<td>6.7</td>
</tr>
</tbody>
</table>
The integration of measles campaigns with routine EPI has been accompanied by strategic improvements in surveillance and laboratory diagnostic support. After SIAs, measles outbreaks have been substantially reduced, and the measles surveillance system is operating to a higher standard, with case-based surveillance providing more accurate data. After the first SIA, most suspected measles cases were investigated and diagnosed as rubella cases. Although case-based surveillance has reduced the false-positive diagnoses for measles, the consequential increase in the number of rubella cases raises questions regarding the use of a measles-only vaccine, and the GoB should consider the benefits of introducing a measles-rubella vaccine, as in Sri Lanka, if not a measles-mumps-rubella vaccine [31]. Furthermore, in accordance with previous reviews [32] and considering that only 83% of children received the first dose of measles vaccine, as opposed to the GoB’s aim of vaccinating >90%, the recommended second-dose vaccination, if included in the standard immunization program, would serve to increase overall coverage and initiate herd immunity.

Despite in-service training for reporting SIAs, simpler, user-friendly information systems may help reduce the extra time and pressure of staff in recording immunization activities. In addition, second-dose catch-up schemes are not included in the standard immunization patient record cards, something that should be included to help focus attention on the need for vaccination by the child’s parents or guardians.

One limitation of the current study design concerns burden of disease. The technique used for data collection prevents the making of definitive statements on changes in the burden of disease despite the inclusion of comments from key informants on this potentially important contribution of SIAs.

The success of the EPI and SIAs for measles eradication and the positive impact on immunization and health care systems is clear. Open involvement in the planning, management, and implementation of SIAs, together with more specific training of staff, has encouraged capacity-building, led to the development of positive health care providers, and created a framework on which other health care interventions for bacterial and viral diseases can be based.

Acknowledgments

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References