

Impact of Measles Elimination Activities on Immunization Services and Health Systems: Findings From Six Countries

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Background. One of the key concerns in determining the appropriateness of establishing a measles eradication goal is its potential impact on routine immunization services and the overall health system. The objective of this study was to evaluate the impact of accelerated measles elimination activities (AMEAs) on immunization services and health systems in 6 countries: Bangladesh, Brazil, Cameroon, Ethiopia, Tajikistan, and Vietnam.

Methods. Primary data were collected from key informant interviews and staff profiling surveys. Secondary data were collected from policy documents, studies, and reports. Data analysis used qualitative approaches.

Results. This study found that the impact of AMEAs varied, with positive and negative implications in specific immunization and health system functions. On balance, the impacts on immunization services were largely positive in Bangladesh, Brazil, Tajikistan, and Vietnam, while negative impacts were more significant in Cameroon and Ethiopia.

Conclusions. We conclude that while weaker health systems may not be able to benefit sufficiently from AMEAs, in more developed health systems, disruptions to health service delivery are unlikely to occur. Opportunities to strengthen the routine immunization service and health system should be actively sought to address system bottlenecks in order to incur benefits to eradication program itself as well as other health priorities.

The declaration of smallpox eradication in 1980 is known as one of the greatest public health achievements

of all time. Two other global eradication program, dracunculiasis and poliomyelitis eradication, have been launched, although their target years have long since passed. One common contributor to the delays is that the residual disease transmissions are in countries with extremely weak health systems [1–2]. A recent evaluation of the poliomyelitis eradication initiative acknowledged the need to contribute to strengthening immunization systems if endemic transmission is to be interrupted [3–4].

Considerable progress has been achieved toward the global goal of 90% reduction in measles mortality by 2010 [5], and five of the six World Health Organization (WHO) Regions have adopted a measles elimination target. Consequently, at the 2010 World Health Assembly, milestones toward measles eradication were

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endorsed [6]. Even though the debate on the tension between a more vertical versus system approach to service delivery has long been part of the public health literature [7–12], the potential impact on routine immunization services and the overall health system remains one of the key concerns in determining the appropriateness of a measles eradication program. Because of the targeted and time-limited nature of an eradication goal and a resource constraint, some authors argued that health system development may be compromised and other programs may be sacrificed or delayed. Others argue that eradication programs have good potential to contribute to health system strengthening [13–15], and a new terminology of a “diagonal” approach has been coined, arguing that resources earmarked for disease control can serve to spearhead improvements in health systems [16–17].

The objective of the present study is to evaluate the impact of AMEAs on routine immunization services and health systems. The study was conducted in 6 countries: Bangladesh, Brazil, Cameroon, Ethiopia, Tajikistan, and Vietnam.

METHODS

The study adapted the WHO health system framework and the framework proposed by Atun et al. for rapid assessment of disease control programs in relation to health systems [18–19]. The health system was described as having 8 interlinked components (Figure 1). A toolkit explaining the methods in detail was developed for the fieldwork [20]. The 6 countries were selected so that different geographical regions, population sizes, income levels, and measles vaccination coverage rates were represented (Table 1).

Methods for collecting primary data included key informant interviews, focus group discussions (where appropriate), and staff profiling surveys. Fieldwork took place between November 2009 and April 2010. In each country, interviews were conducted at national level and at service delivery level in either one or two selected districts. Key informants were selected on the basis of their experience in



Figure 1. Health systems framework used in the study.

immunization services or relevant health system areas, representing all administrative levels and different institutions. Semi-structured questionnaire was used and informed consent was sought prior to each interview. Between 22 and 60 key informants were interviewed in each country. Staff profiling surveys were done in two districts of each country using a self-administered questionnaire. Secondary data including policy documents, studies and reports were reviewed.

The process of research was iterative, as ideas emerging from the interviews informed the methodology and guided collection of further data. Data analysis followed a framework analysis approach [21–22]. Qualitative data were validated through triangulation of data sources and deviant case analysis. The level of integration was assessed in each of the eight critical functions of a health system [16]. Ethical approval was obtained from the London School of Hygiene and Tropical Medicine (LSHTM) Ethics Committee and national committees in the countries.

RESULTS

Governance

According to key informants in all countries, AMEAs contributed to partnerships building across Ministry of Health departments and stimulated collaboration across partner agencies to improve Expanded Program on Immunisation (EPI) governance and service delivery. In Bangladesh, Ethiopia, and Tajikistan, open involvement of communities and community leaders had improved the accountability of EPI and raised awareness about the importance of immunization at both national and local levels. In Cameroon, Vietnam, Bangladesh, and Tajikistan, measles supplemental immunization activities (SIAs) fostered active involvement from political leaders.

“After the SIAs, local authorities are more attentive and responsive to child health care issues”—district hospital physician in Tajikistan.

However, some key informants in Cameroon and Ethiopia expressed concerns over the imposition of funding conditions and the use of SIAs as the main elimination strategy. Donor earmarking of funding for measles activities was perceived as undermining local resource allocation decisions. They also believed that the implementation of measles SIAs as a priority activity separated from general health system strategies contributed to fragmented policy-making and priority-setting. In Ethiopia and Tajikistan, measles SIAs were perceived by some to have reduced motivation for adequate investment in broader health service delivery and primary health care.

Planning and Management

AMEAs helped develop strategies and skills required for planning and management at all government levels and

Table 1. Demographic and Economic Summary Statistics of 6 Study Countries

Country	GNI ^a per capita (2008, \$)	2010 projected population	2008 estimated MCV1 ^b coverage	Type of measles vaccine used in routine services
Bangladesh	520	164,425,000	89%	Measles
Brazil	7300	195,423,000	99%	MMR ^c
Cameroon	1150	19,958,000	80%	Measles
Ethiopia	280	84,976,000	74%	Measles
Tajikistan	600	7,075,000	86%	MR ^d
Vietnam	890	89,029,000	92%	Measles

NOTE. ^a GNI: gross national income.

^b MCV1: first dose of routine measles vaccine.

^c MMR: measles-mumps-rubella combined vaccine.

^d MR: measles-rubella combined vaccine.

Sources: Population projection from UN Population Division (esa.un.org/unpp/); GNI per capita from World Bank (<http://data.worldbank.org/indicator/NY.GNP.PCAP.CD>); MCV1 coverage from WHO UNICEF estimates.

stimulated interdepartmental and intersectoral planning. This is particularly the case in Cameroon and Ethiopia, where they have used the opportunity of annual Child Health Days to deliver measles vaccines, which involve complex planning of multiple child health-related interventions. Strengthened skills included the capacity to identify, map, and target hard-to-reach populations both for vaccination and other outreach activities. In Ethiopia, preparations for SIAs required the development of innovative strategies to cover the underdeveloped Afar and Somali regions, while in Tajikistan, SIAs achieved high coverage among groups that are traditionally geographically isolated for parts of the year.

Management skills acquired in the process of implementing measles activities were reported to be applicable to other preventive activities, such as planning for pandemic influenza vaccination. Key informants in Bangladesh and Tajikistan mentioned the stimulation of a culture of long-term planning in the health sector as another positive impact. However, in Cameroon, informants reported that measles SIAs could interfere with the planning of routine EPI activities and other health services at regional and district levels. This is mainly because of the short notice given from the national level, with many SIAs being conducted each year for various diseases.

“If we knew at the beginning of the year when the campaign would take place, we would be able to solve many issues”—Cameroon health facility staff.

Financing

Findings from key informant interviews show mixed patterns of impact of AMEAs on financing of immunization services in particular and health systems in general. In all countries except Brazil, measles elimination activities helped leverage additional fundraising from local and international partners to deliver both measles activities and additional public health interventions. It was also reported that in Bangladesh, Tajikistan, and Vietnam, skills in fundraising were enhanced.

At the same time, there was also concern that the motivation to strengthen routine immunization services and the health system in general could be reduced because external funds were channeled primarily to finance measles SIAs rather than routine vaccination services. Earmarking of donor funding for SIAs was perceived in Cameroon as possibly detrimental to longer-term investment in routine vaccination services. However, there was no quantitative evidence from budget allocations to show a decrease in resources for non-measles EPI funding in any of the countries. While external partners almost fully funded the Bangladesh catch-up SIAs in 2005–2006, the government largely funded the catch-up SIAs in 2010. In Cameroon, external partners were responsible for the financing of vaccines procurement and delivery as well as integrated interventions during SIAs. In Bangladesh and Vietnam, tensions were reported regarding financing at the district and provincial levels to cover the operational costs of SIAs.

“A Civil Surgeon had to ask local health officers to manage money for organizing the SIAs from their own sources, as funds from headquarters were delayed”—informant in Bangladesh.

Human Resources

In many countries, the quantity and quality of EPI staff were reportedly increased because of AMEAs. Although the number increased, most were volunteers such as youth and women’s groups that were mobilized for measles SIAs or temporary and retired staff for other EPI activities. With regard to quality, key informants in all countries stated that additional staff training provided as part of preparations for AMEAs helped improve the knowledge and skills of health staff on immunization planning, management, and service delivery, as well as disease surveillance, laboratory diagnosis, and information management. In Brazil, skills in vaccine-preventable disease surveillance were especially noted to have improved as a result of AMEAs.

“Yes, knowledge and skills of my commune health centre staff on reporting, injection technique, campaign planning, and community mobilization was improved a lot.”—Vietnam commune health centre staff.

The use of incentives and different remuneration mechanisms for staff engaged in measles-related activities produced mixed results. The level of SIA payments when compared with salaries is low in Vietnam, Bangladesh, and Tajikistan, but could be as high as half of salary income (or more) for some involved personnel in Cameroon and Ethiopia (Table 3). Key informants in Bangladesh and Ethiopia reported that the incentives provided by AMEAs helped motivate staff to become more committed to their responsibilities. In Ethiopia where additional remuneration provided for SIAs was considerably higher than the government allowance, it reportedly contributed to the retention of health workers in the public sector. However, negative impacts on other staff not directly involved in AMEAs were reported. In Cameroon and Tajikistan, some key informants stated that staff may have been less motivated to perform routine immunization activities and other primary care tasks because of the lack of incentives for routine activities.

There were reports of EPI staff feeling overloaded from additional work from SIAs in Bangladesh, Cameroon, Ethiopia, and Vietnam. Results from the staff profiling surveys in Bangladesh, Cameroon, and Ethiopia show that more than two-thirds of the surveyed staff reported skipping other important tasks because of SIAs (Table 4).

“I was alone during the campaign [to carry out all other activities]”—Cameroon health facility staff.

In Brazil, measles SIAs were only conducted during the weekends with the participation of community volunteers, helping to avoid interruptions to routine services. Key informants in Bangladesh stated that SIAs enhanced the capacity of immunization staff to work under pressure, while in Tajikistan, they reportedly became more energized and motivated to work on other EPI activities because of the feeling of achievement developed from expanding vaccination coverage and positive feedback on their work.

Logistics and Procurement

“During SIAs, we received a new refrigerator”—vaccinator in Tajikistan.

AMEAs were reported to contribute to the improvement of cold-chain system and logistics in all 6 countries. In Cameroon and Tajikistan, investment in storage and better management of contaminated sharps became useful for services beyond the EPI programs. Logistics-related skills were enhanced, and in Tajikistan, the benefit extended to the drug delivery system since the skills learned from vaccine management were also applied to other pharmaceutical products; an increasing share of these tasks were taken up by government services. However, in Cameroon, a substantial share of transportation deployed during measles SIAs were rented rather than purchased, so an opportunity to strengthen the routine EPI program after the SIAs was lost.

Information System

One significant positive impact on the national health information system from AMEAs was from better information on

Table 2. Most Recent Measles SIAs^a in 6 Study Countries

Country	Year of most recent SIAs	Target population	Type of SIAs	Vaccine used	Additional interventions included in SIAs
Bangladesh	2010	20,000,000	Follow-up	Measles	Vitamin A and polio vaccine
Brazil	2008	69,700,000	Catch-up	MMR ^b	Catch-up EPI vaccines, health education on dental care, hypertension, diabetes, and sexually transmitted diseases
Cameroon	2009	3,435,546	Follow-up	Measles	Vitamin A, polio vaccine, catch-up EPI vaccines (including TT ^b for women, IPTp ^c , antihelminthics ^d , and yellow fever vaccine in selected districts)
Ethiopia	2009	276,695	Follow-up	Measles	Vitamin A and antihelminthics ^d
Tajikistan	2009	2,340,440	Catch-up	MR ^e	Vitamin A and antihelminthics ^d
Vietnam	2009	1,036,222	Subnational follow-up	Measles	Vitamin A

NOTE. ^a SIAs: supplemental immunization activities.

^b MMR: combined measles, mumps and rubella vaccine.

^c TT: tetanus toxoid vaccine.

^c IPTp: intermittent preventive treatment in pregnancy.

^d Mebendazole or albendazole for deworming.

^e MR: combined measles and rubella vaccine.

Table 3. Survey Results on the Time Required for Measles SIAs^a and Estimated Remuneration

Country	No. of respondents	Range of no. of days spent on measles SIAs/campaigns (median)			Estimated SIA remuneration as % of monthly salary
		Planning	Implementation	Evaluation	
Bangladesh	60	2–42 (13.33)	1–30 (10.9)	N/A ^b	16%
Cameroon	16	2–21 (6.31)	3–10 (6.13)	0–4 (2.19)	6%–360% (43%)
Ethiopia	36	1–20 (5.6)	3–30 (9.8)	0–4 (1)	36%–562% (157%)
Tajikistan	25	30–180 (73)	15 (15)	0–20 (12)	0%–91% (35%)
Vietnam	351	1–15 (7.02)	2–12 (2.52)	N/A	Less than 10%

NOTE. ^a SIAs: supplemental immunization activities.

^b N/A: not available.

the target population. The expansion of or the improvement in birth registration in Bangladesh, Ethiopia, and Vietnam is valuable for other EPI activities and health programs. In Tajikistan, AMEAs provided an incentive to reconcile differences between census and facility data, and a basis for coverage calculation was agreed upon. Additionally, measles SIAs contributed to the mapping of targets and hard-to-reach populations for EPI outreach activities in Cameroon and Tajikistan.

However, in Ethiopia and Bangladesh, the national information requirements from SIAs generated many forms to be completed and submitted separately from the routine reporting system, thus creating an additional workload. A similar pattern of duplication occurred in Tajikistan, but was mostly due to the reporting protocol in the public health system in general rather than an impact of the SIAs. In Cameroon and Ethiopia, data collected during SIAs were sent directly to the national level without adequate utilization at lower levels.

Surveillance

An integral part of AMEAs is a move from population-based to case-based measles surveillance. All countries reported that AMEAs strengthen disease surveillance skills among EPI staff. National surveillance systems benefited through integrated surveillance for a number of vaccine-preventable diseases and other diseases. New laboratory equipment was purchased in Brazil and Vietnam, which was used for other disease control activities. In Cameroon and Ethiopia, financial incentives provided for

reporting measles cases through the Integrated Disease Surveillance Response system were found to have improved other disease reporting. At the same time, some key informants in Cameroon voiced concerns over the sustainability of current measles surveillance since it largely depends on polio eradication program staff.

Service Delivery

One major concern over the impact of AMEAs was on the performance of the routine immunization system. One key assessment is the change in EPI coverage in relation to measles SIAs. At the national level, our study found no pattern of decrease in DPT3 (third dose of the combined diphtheria/pertussis/tetanus vaccine) coverage in the years of measles SIAs in any of the 6 countries (Figure 2). Vietnam's big reduction in DPT3 coverage in 2002 was due to a shortage of vaccine [23]. Latest statistics for 2009, however, show a decline in DPT3 coverage in Ethiopia and Cameroon. At the district level, data on coverage trends in the study districts were not always available, but findings from staff survey indicated that the impact on routine immunization was perceived to be more positive than negative (Table 4).

One commonly reported benefit of AMEAs on immunization services was its capacity to raise community awareness on the benefits of vaccination and primary health care. Resources made available for SIAs mobilization through national and local media also reportedly contributed to increased uptake of routine

Table 4. Survey Results on Staff Opinions Regarding the Impacts of Measles SIAs^a

Country	No. of respondents	Skip important tasks because of campaign (%)	Believe measles SIAs slow down routine immunization (%)	Believe measles SIAs improve routine immunization (%)	Support having measles elimination goal (%)
Bangladesh	60	86	0	83	87
Cameroon	16	75	60	93	100
Ethiopia	36	72	18	93	100
Tajikistan	25	N/A ^b	24	100	100
Vietnam	60	21	5	84	96

NOTE. ^a SIAs: supplemental immunization activities.

^b N/A: not available.

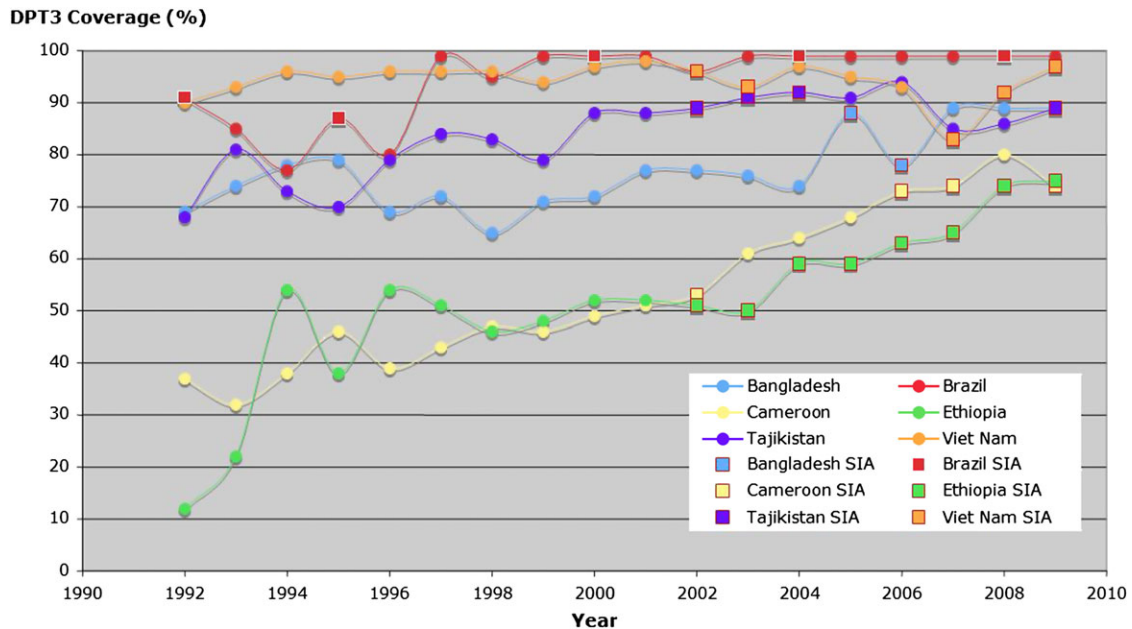


Figure 2. DPT3 coverage trends in relation to the years with measles SIAs in the 6 countries. Source: coverage data from WHO/UNICEF coverage estimates as of July 2010, http://www.who.int/immunization_monitoring/routine/immunization_coverage/en/index4.html. Note: DPT3 indicates three doses of the combined diphtheria/pertussis/tetanus vaccine; SIAs, supplemental immunization activities; WHO, World Health Organization; UNICEF, United Nations Children's Fund.

vaccines. It was reported that measles SIAs provided the opportunity to trace and vaccinate defaulters for other vaccines. In Cameroon and Tajikistan, there was an increase in outreach activities to hard-to-reach populations, thus facilitating access to vaccination and other primary care services for these populations. Measles SIAs also stimulated collaboration between state and nonstate private providers to jointly provide services.

“Before SIAs, we used to visit to the people, motivate them to bring their children to the center, but now people themselves mostly come to EPI centers, which helped in improving coverage of other vaccines...this is just because of SIAs and publicity”—national-level key informant in Bangladesh.

“...SIAs help us to reach unreached children”—district EPI director in Tajikistan.

Demand for vaccines has increased through social mobilization. However, in Cameroon, where vaccine preventable diseases SIAs are regularly conducted, there were concerns that the population might become more passive, possibly waiting for the next campaign rather than actively seeking to complete the routine vaccination schedule.

Because of AMEAs, the quality of immunization service delivery, especially with regard to injection safety and hygiene, was reportedly improved in most countries. Measles SIAs have provided a platform for additional vaccines, including yellow fever, polio, tetanus, BCG, or pentavalent vaccines (Table 2). Other public health activities were included as well; for example, delivering insecticide-treated bed nets (ITNs), vitamin A supplementation, antihelminthics, and nutritional screening.

However, it was noted that multiple integrated interventions in SIAs can, in certain circumstances, put pressure on service delivery and be complex to manage.

The effects on other health care services were mixed. In Cameroon and Ethiopia, health care services were interrupted during the SIAs because of both shortage of staff and inadequate preparation, frequently due to the short notice of the event. Some activities at health centers and hospitals were suspended temporarily or only limitedly provided. However, in Bangladesh, key informants stated that health care utilization rates for ante natal care (ANC) and other primary health care activities had increased due to public mobilization associated with AMEAs. In Tajikistan, there was also an increased demand for primary health care services through social mobilization at the local level, which was initially initiated to support SIAs. Significant reductions in measles outbreaks and morbidity after vaccination also freed up health care facilities in all countries.

“Most young doctors have never seen a measles case”—senior pediatrician in Cameroon.

DISCUSSION

Earlier studies on polio eradication emphasized potential negative implications for health systems because of resource diversion from routine immunization services and other health programs, particularly in financial and human resources [24–25]. Our study shows that there is no evidence of a direct financing impact from AMEAs at the national level. This is likely

due to the high financial support for vaccines provided by external partners in most countries. Success in measles SIAs was even quoted to bring credibility to the EPI program in order to be able to secure more support.

The possible negative impact on workload and interruption of services was confirmed in this study from both key informant interviews as well as surveys of fieldwork staff. One factor contributing to higher interruption from AMEAs is due to the need to mobilize qualified vaccinators for measles vaccine injection, which is not required in polio campaigns. Delays and interruption of health services were reported to vary, and was particularly worse when planning at the district level was not done well in advance. Although the period of disruption tends to be short, in Cameroon, it was argued that the high number of SIAs covering multiple antigens each year strained both planning and service delivery.

A number of positive impacts on immunization services were reported in the country studies. Many of them were the result of having measles activities integrated in the EPI system. Better health care staff skills from immunization service and program management training, and better equipment and information systems for surveillance, monitoring, and evaluation also benefited the EPI program altogether when these activities are not delivered in a newly established or separate system. Better coordination with other sectors helped expand the network and collaboration efforts in future SIAs and mass campaigns for other preventive health programs.

Additional positive impacts beyond immunization occurred when other health care interventions were added to measles SIAs or outreach services where existing delivery systems were weak. Immunization programs have long been viewed as a natural vehicle for public health interventions and contributed to increased coverage of the combined interventions, higher efficiency of service delivery, and enhanced equity for multiple interventions in hard-to-reach populations [26]. It has been argued that key success factors for the integration of interventions with SIAs are program compatibility and the existence of a robust EPI program [27]. We note that in our study, integrated interventions are primarily used in countries where the health system is relatively weak. Both the number and the effectiveness of integrated interventions in SIAs are rarely evaluated.

Despite our mixed findings on the impacts with mostly positive effects on many functions, the effects were not equally manifested in all 6 countries. Low-resource countries with weaker underlying systems tend to bear more unfavorable impacts and opportunity costs from AMEAs. Sustainability of effective service provision is also more at risk when these countries have less integration of programs' interventions in the mainstream health system. Earmarking of funds and the separation of logistics or reporting systems is not conducive to long-term strengthening of routine immunization services and the health system. Inversely, when the level of integration between AMEAs,

routine immunization services, and the health systems is greater, benefits tend to be higher, such for disease surveillance and health service delivery activities.

Avoiding negative impacts alone is not adequate. Even though eradication programs cannot be expected to solve all the problems in the health system, it is argued that opportunities to strengthen routine immunization services and contribute to health system development need to be actively sought and action taken [13]. A measles eradication strategy should help tackle root causes in the health system that would incur benefits to several priorities simultaneously, thus leveraging the opportunity for success of its program [28]. In this study, AMEAs were not shown in any of the study countries to have explicit objectives to help strengthen the health system capacity beyond improving EPI service and disease surveillance.

There are a number of study limitations. Assessing the impact of AMEAs is not straightforward conceptually. Separating the impact of the measles vaccination program from other ongoing immunization efforts is difficult because in all 6 countries, there are varying degrees of integration of AMEAs in the existing immunization services. Additionally, the health system is not static, with ongoing changes and reforms that complicate the assessment of impact.

CONCLUSIONS

Our findings show that the impact of AMEAs on vaccination services and health systems are varied. There are both positive and negative implications on immunization and in most of the health system functions. The results also varied with national system capacity and context as well as the way the AMEAs were implemented. On balance, positive impacts were acknowledged in Bangladesh, Brazil, Tajikistan, and Vietnam, while more negative impacts were reported in Cameroon and Ethiopia. The study suggests that weaker health systems may not be able to benefit sufficiently from the AMEAs, while in more developed systems disruptions are unlikely to occur. Opportunities to strengthen routine immunization service and the health system should be actively sought to address system bottlenecks and incur benefits to other health priorities, as well as increase the opportunity for success of the measles eradication program.

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