Combining Global Elimination Of Measles And Rubella With Strengthening Of Health Systems In Developing Countries

ABSTRACT Global efforts to eliminate measles and rubella can be combined with other actions to accelerate the strengthening of health systems in developing countries. However, there are several challenges standing in the way of successfully combining measles and rubella vaccination campaigns with health systems strengthening. Those challenges include the following: achieving universal vaccine coverage while integrating the initiative with other primary care strategies and developing the necessary health system resilience to confront emergencies, ensuring epidemiological and laboratory surveillance of vaccine-preventable diseases, developing the human resources needed to effectively manage and implement national strategies, increasing community demand for health services, and obtaining long-term political support. We describe lessons learned from the successful elimination of measles and rubella in the Americas and elsewhere that strive to strengthen national health systems to both improve vaccine uptake and confront emerging threats. The elimination of measles and rubella provides opportunities for nations to strengthen health systems and thus to both reduce inequities and ensure national health security.

The Bill & Melinda Gates Foundation conceptualized the Decade of Vaccines as a way of ensuring that immunization, considered the “best buy” in global health, continues to be available to all of the world’s children. The Global Vaccine Action Plan, approved by the World Health Assembly in 2012, provides a specific road map for achieving this vision by 2020. A key goal of the plan is to eliminate measles and rubella in at least five of the six World Health Organization (WHO) regions of the world by 2020. The new United Nations Sustainable Development Goals of 2015 include a health goal to “ensure healthy lives and promote well-being for all at all ages.” The goal states that many more efforts are needed to fully eradicate a wide range of diseases. Thus, elimination of measles and rubella is in alignment with world development goals for the next fifteen years, as well as with the Global Vaccine Action Plan.

Congenital rubella syndrome is a devastating disease that leaves a child facing a lifetime of suffering from any combination of the following effects: intellectual disability, autism, blindness, deafness, and cardiac defects. The syndrome occurs in babies whose mothers were infected with the rubella virus during the first trimester of pregnancy. The in utero infection is totally preventable if mothers have been vaccinated before pregnancy. Rubella vaccine is usually combined with measles vaccine at minimal increased
cost, compared to measles vaccine alone. Both measles- and rubella-related diseases can be eliminated.4

Many experts argue that the elimination of measles and congenital rubella syndrome is one of the best public health investments that can be made.5–7 Thus, when countries developed national plan targets as part of the Global Vaccine Action Plan, most low- and middle-income countries identified measles and rubella elimination as top priorities. However, despite the clear benefits of investing in measles and rubella elimination, such disease elimination initiatives have been criticized for having insufficient impact on strengthening or sustaining health systems.8,9

There are many challenges involved in linking the measles and rubella elimination initiative more closely with health systems strengthening. The challenges include achieving universal vaccine uptake (referred to as “coverage”) while integrating the initiative with other primary care strategies and developing the necessary health system resilience to confront emergencies, ensuring epidemiological and laboratory surveillance of vaccine-preventable diseases, developing the human resources needed to effectively manage and implement national strategies, increasing community demand for health services, and obtaining long-term political support.

For the purposes of this article, health systems are defined as organizations of people, institutions, and resources that strive to deliver health care services to meet the needs of the population. Health systems strengthening is defined as the process that improves the performance of health systems.

Health systems work to improve the health of the populations they serve while responding to people’s legitimate expectations and protecting them from ill health. The Global Vaccine Action Plan is fundamentally aligned with health systems strengthening because its provision of vaccines to reduce disease burden is grounded in country ownership, partnerships, and civil-society demand. This article provides perspectives on opportunities to strengthen health systems through eliminating measles and rubella within the context of the Global Vaccine Action Plan. In many low- and middle-income countries, health systems also provide immediate opportunities for accelerated prevention of measles and rubella.

Universal Health Coverage
In many low- and lower-middle-income countries, national immunization programs are the backbone of the primary health care delivery system and its capacity to respond to emergencies.9 Additionally, when a country is confronted with challenges of displacement or refugee populations, one of the first health interventions imposed is vaccination, together with the provision of shelter, food, safe water, and sanitation. In many isolated rural communities, immunization may have been the first health service introduced. Immunization along with safe water and sanitation are often suggested as key factors in increases in life expectancy over the past fifty years in many developing countries, and they have certainly contributed to the reduction in mortality.10

Routine immunization programs are a fundamental component of any well-functioning health service program. Similarly, immunization program performance is a key measure of the successful delivery of health services and of a country’s response to emergencies. However, reduction of disease burden by episodic immunization campaigns through supplemental immunization activities does not automatically translate into strengthened basic health services.8,9 For example, supplemental polio immunization activities typically occur over a day or a few weeks and are spaced one or two months apart. They are not a daily activity that would be easily integrated into basic health service delivery. In the case of measles and rubella, follow-up campaigns typically occur every three or four years, again making it difficult to support an emphasis on stronger routine care.

The world is far from achieving full protection for all children with all of the vaccines recommended by the WHO. In the past decade, the share of children who receive three doses of diphtheria-tetanus-pertussis (DTP) vaccine in most countries and regions has stagnated at around 80–84 percent.11 The challenge is reaching that remaining 20 percent or so of children, sometimes called the “fifth child,” with three doses of DTP vaccine, as well as with doses of the other recommended vaccines.

To reach the fifth child requires synchronizing multiple program components. These include well-functioning health care centers, accessible hours of health service provision, the use of all opportunities to vaccinate children (regardless of the reasons for their health care visits), outreach to expand access when fixed health sites are not available, the uninterrupted supply of vaccines, a functioning cold chain to store vaccines under proper temperature and safety conditions, the reporting of accurate vaccine coverage data, both overarching national immunization plans and localized microplans for implementing immunization activities at the community level, community demand for vaccines,
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adequate management and supervision at all levels of the program, and well-educated and committed clinicians.\textsuperscript{11}

Failure to vaccinate is a cause of measles outbreaks, as it has been for a long time.\textsuperscript{12,13} In some situations, as many as half of the children who contract measles had a recent clinical visit at the appropriate age for vaccination, but they were not vaccinated.\textsuperscript{12} Other children drop out of routine immunization programs or are not vaccinated because of clinicians’ practices, such as imposing false contraindications for vaccination.\textsuperscript{13} For vaccination programs to have sufficient impact requires an aggressive, well-planned, and proactive approach to health systems strengthening. The need for such an approach is easily overlooked in the enthusiasm of implementing a vaccine campaign.

In response to vaccination challenges, the WHO—with the support of interested partners—has promoted a “second year of life” platform, which emphasizes using any health visit in the second year of life as an opportunity to vaccinate children who are not up-to-date on any of their vaccinations. Using best practices, this strategy seeks to promote immunization efforts and integrate them with strategies for deworming, growth monitoring, providing bed nets for malaria prevention, and the administration of micronutrients (such as vitamin A in areas where its deficiency remains unchecked).\textsuperscript{14} Successful implementation of the second-year-of-life strategy thus goes far beyond measles and rubella, providing opportunities to strengthen health services for multiple child survival targets, including the prevention of malaria and neglected tropical diseases and the correction of micronutrient deficiencies.

Besides the WHO and UNICEF, the second-year-of-life partnership includes the Centers for Disease Control and Prevention (CDC), the American Red Cross, the Sabin Vaccine Institute, and the International Pediatric Association. The strategy is intended to complement the goal of having every child fully vaccinated by one year of age.

**Epidemiological And Laboratory Surveillance Of Vaccine-Preventable Diseases**

A strong routine immunization program is often at the forefront of any response to emergencies. To successfully stop Ebola transmission in Nigeria in 2014, the national immunization program—in particular, its polio eradication team and infrastructure—shouldered much of the response.\textsuperscript{15,16} But having a sufficient supply of health care workers is not enough. The management and deployment of those workers to respond capably to a crisis was critically important in Nigeria. Nigeria’s recent experience is an exception to the more typical experience in many developing countries, where the reemergence of Ebola, pandemic influenza, and dengue have revealed striking weaknesses in the capacity of national, regional, and global surveillance systems to rapidly detect and respond to infectious disease challenges.\textsuperscript{17} Often national immunization programs are among the few resources available to public health systems, and as a result the programs are frequently charged with responding to such threats even when vaccines are not readily available.

A key lesson from years of experience of combating measles virus importations in the Americas is the importance of early detection as part of a well-functioning surveillance system. Most countries—such as Argentina, Brazil, Chile, Colombia, Honduras, Paraguay, Peru, and those in the Caribbean—learned that early implementation of high-quality surveillance and use of information gathered through surveillance to guide immunization and response strategies is an achievable target.\textsuperscript{18,19} But effective surveillance systems in low- and middle-income countries in the context of health systems strengthening depends on strategies that take advantage of previous health initiatives’ achievements. The foundation of success for smallpox eradication and the plan for the “polio legacy” once polio is eradicated can be built upon to address measles, rubella, and congenital rubella syndrome.\textsuperscript{20} (The polio legacy refers to the transfer of resources currently being used to eradicate polio to other challenges such as the elimination of measles and rubella.)

A well-functioning surveillance system is grounded in the core value of cooperation among countries for cross-border coordination of disease control, the capacity to identify problems and design solutions to them, the sustain-
ability of interventions, political commitment, program management with effective technical oversight, the coordination of a network of laboratories, and available surge capacity to respond to unusual circumstances. In many countries it is difficult to provide these components, but there are some lessons learned that are worth noting.

In the Americas, preventing measles and rubella and tracking the impact of immunization progress was built on the approach used with polio. This approach included managing reporting sites (for example, through monthly supervisory site visits), the use of standardized procedures for investigation and reporting, and the use of a network of laboratories for rapid confirmation of suspected cases. In the cases of measles and rubella, blood specimens taken from every suspected case of rash and fever were tested for both measles and rubella immunoglobulin M.

Eventually the measles laboratory network in the Americas expanded from a handful of polio labs to include 124 subnational, 21 national, and 2 regional labs and 1 global specialized lab. The labs in the network use state-of-the-art technology for rapid detection of emerging infections and their trends. For example, the labs can monitor the genetic drift of influenza viruses and determine the molecular epidemiology of measles and rubella viruses. The latter is particularly critical for determining whether the virus was locally acquired or imported from another country or region. Genetic sequencing of measles viruses isolated in 2015 in Mexico and Canada determined that they originated from an outbreak in Southern California and not from within those two countries.

Such work also helps mitigate risks to national security when new crises emerge. The question is not if such crises will emerge, but when they will emerge. Preparedness and building health systems on foundations of success are essential.

Human Resource Capacity
Delivering vaccines, implementing effective surveillance, and responding to emergencies requires a well-trained workforce. In the United States the CDC’s seven thousand disease control experts are an invaluable resource for strengthening the national health system, especially the health systems approach to supporting prevention and response. CDC experts can be mobilized to respond quickly despite the enormous challenges of the fragmented US health care delivery system. The public health workforce has evolved despite complicated public-private interests and a challenging network of federal, state, and local health authorities, as demonstrated in the response to the threat of Ebola.

The detection of H1N1 influenza virus in Mexico in 2009, and subsequently throughout other countries in the Americas, benefited from the laboratory experience with measles and rubella in the region. In Mexico, in particular, trained epidemiologists and virologists applied best practices of working with measles and rubella to the rapid detection of and response to what eventually became a novel pandemic virus. Within weeks the virus spread to Colombia and the rest of South America. Public health experts were also able to detect and respond to the pandemic virus, which ultimately created a substantial demand for an informed public for vaccine and the subsequent implementation of influenza vaccination.

Many of the lessons learned from vaccination programs center on technical, managerial, and leadership capacity building for the workforce. In India the Danish International Development Agency recognized the challenges faced by India’s health system in confronting a plague-like outbreak in Sarat, Maharashtra, in 1994. To this day, it is still unclear what caused the “plague” scare that led to airlines’ refusing to fly to India, embassy closures, public fright, and the loss of millions of dollars in revenue. In any case, the Danes agreed to provide a $12 million grant to the WHO and the Ministry of Health and Family Welfare of India for polio surveillance development. The Danish International Development Agency recognized the gravity of the surveillance problem in India and decided to initiate efforts in a targeted way, beginning with polio eradication. However, its vision was obviously broader and was aimed at strengthening surveillance for priority infectious diseases.

The original polio surveillance system in India
is now supported by a network of highly trained and motivated field staff members. They are tackling the elimination of measles, rubella, and other vaccine-preventable diseases in the country and tracking routine immunization sessions. Their work has been recognized as contributing to India’s receiving certification from the WHO for having eliminated maternal and neonatal tetanus. It has also contributed to efforts to improve routine vaccination coverage and to eliminate measles and rubella. Given the enormous challenges, especially in the vast rural and poor areas of the country, this work represents an extraordinary accomplishment.

Community Engagement
Involving the beneficiaries of health services in the planning and implementation process to the fullest extent possible would also help strengthen both immunization delivery and other health services. Such involvement would include regular briefings of key leaders and the solicitation of their feedback. However, communities are often engaged only when there is an available budget, an immediate priority, or a specific campaign need. In the case of eliminating measles and rubella, community engagement to reach unvaccinated children should be used to sustain community demand for immunization and other services. Relationship building is hard, but that is the core of community engagement. Sustained investment in communities is essential to avoid missing opportunities to reach every family with better health services.

Protecting public trust in immunization is a fundamental guiding principle in trying to reach all citizens with immunization services. If vaccines and their providers are not to be trusted, what about other health services? Central to community relationship building is the requirement for long-term action-oriented partnerships, not only to eliminate measles and rubella but also to sustain community involvement and support in the future.

In 2006 in Peru a mass campaign for vaccination against measles and rubella was delayed by a year largely because of false allegations in the legislature that the measles-rubella vaccine caused autism. In the year that the campaign was delayed, approximately ten babies were born with congenital rubella syndrome. Public demand reversed the decision to stop the campaign, and as a result rubella was eliminated in Peru.

The elimination of congenital rubella syndrome led to widespread implementation of hearing screening of all newborns as a standard of care in Costa Rica and other Latin American countries. Communities and civil societies recognized that congenital rubella syndrome was not the only cause of hearing loss in newborns and developed services to address care needs for other causes, too. Similarly, through networking of the local pediatric societies with support from the Pan American Health Organization, the International Pediatric Association, and other committed civil-society partners, “TORCH” maternal antenatal serology titer screening for the presence of possible infections in utero has become a widely accepted standard of care throughout Latin America and the Caribbean. TORCH stands for toxoplasmosis, other (syphilis), rubella, cytomegalovirus, and herpes. TORCH screening was implemented because of the recognition that there are other causes of congenital malformations besides rubella, and that affected babies would need the support of health services.

Eliminating measles and rubella would unquestionably require sustained efforts. The enthusiasm and relationships generated in developing the strategy and implementation of successful immunization campaigns provide partnership opportunities for strengthening basic health services, as described above. The public-private partnership approach has been fundamental to the success of the measles and rubella initiative. The role played by the private sector and health care professionals in the Global Vaccine Action Plan has varied across countries, but in general those professionals have been underused. In our view, this represents a missed opportunity.

In 2012 the American Academy of Pediatrics and the International Pediatric Association—both of which represent pediatricians in academic, public health, and primary clinical care—were
included as partners in the measles and rubella elimination initiative. These organizations added strong voices concerned with the delivery of health services and offered technical experts and strategies for closing gaps in some countries between public and private health services through a shared public-private commitment to protecting families from vaccine-preventable diseases.

National ownership is key to successful and sustained immunization programs. The International Pediatric Association is an organization that represents the national pediatric societies of more than 150 countries. Engaging national societies to work toward Global Vaccine Action Plan goals in their countries brings an added dimension to strengthening national health systems. Local leaders of these societies can be effective advocates for commitments from elected officials in ways that are often not possible for public health officials. As nongovernment actors, pediatricians retain a high level of public trust. They can use that trust and their knowledge of local circumstances to help shape national immunization policy and to serve families. Pediatricians can also help educate the broader health community and both traditional and social media to address misinformation and vaccine hesitancy.

Pediatricians are often members of civil-society organizations important to the character of the community and its attitudes. The measles and rubella elimination initiative has encouraged national pediatric societies to partner directly with local civil-society organizations. Because pediatric training emphasizes continuous child growth and development and the prevention of disease, pediatricians are natural advocates for strengthening community health services in both public and private settings. And as experienced clinicians, private-sector pediatricians can augment early detection and disease surveillance. Private provider engagement and leadership can help prevent delayed responses and thus help contain outbreaks of vaccine-preventable diseases.

Helping national pediatric societies understand and maximize their potential roles in the Global Vaccine Action Plan is a priority for the International Pediatric Association and the American Academy of Pediatrics. Pediatricians understand that discretely labeled program streams and infrastructure for routine immunization services, the global polio eradication initiative, efforts to eliminate measles and rubella, new vaccine opportunities, and the second-year-of-life strategy have a common target: the health of the child. This reality speaks to the need for comprehensive approaches to community-based health systems that reach children and their families at the local level.

**Conclusion**

Efforts to eliminate measles, rubella, and congenital rubella syndrome could provide important opportunities for strengthening health systems. However, taking advantage of such opportunities does not happen spontaneously. Effectively strengthening health systems while pursuing the elimination of measles and rubella requires careful planning and implementation that includes a highly dedicated team of health professionals with a vision to integrate their work whenever appropriate with other primary health services, the capacity to surge in response to unexpected threats, high-quality surveillance, and the engagement of community and professional societies. Achieving sustainable health systems will contribute to better health for all of the world’s children.


25 Cousins S. India is declared free of maternal and neonatal tetanus. BMJ. 2015;350:h2975.


