

The Polio Eradication and Measles Elimination: What We Learnt What Need We Do

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Since the mid-1970s, the widespread establishment and implementation of the Expanded Programme on Immunization (EPI) has led to remarkable achievements in controlling vaccine preventable diseases worldwide. Today, more children than ever are being reached with immunization. Interruption of poliomyelitis transmission has occurred in most countries; and measles was eliminated by the PAHO (Pan American Health Organization). With the establishment of EPI, there was a gradual shift in emphasis from vaccination campaign strategies using mobile teams to the delivery of immunization services as part of routine health services of health facilities. Both the campaign and the outreach strategies are nevertheless required to reach those segments of the population not reached by the routine health services and to accelerate the achievement of disease control initiatives such as polio eradication and measles elimination. The EPI requires long-term sustainable approaches to protect new cohorts of susceptible persons with vaccination and monitor trends and progress towards disease control with high quality surveillance [1].

The principles of disease eradication are encapsulated in a constellation of four conditions: biologic feasibility, adequate public health infrastructure, sufficient funding, and sustained political/societal will [2]. Based on the weakening sustained political/societal will, both insufficient funding and inadequate public health infrastructure, in 2001 it was estimated that measles vaccination coverage for the 1998 Campania birth cohort was 65% and causes the measles outbreak in Campania [3]. Since polio free achieved, too many regions and communities have ceased to worry about polio. As a consequence, rates of vaccine uptake are all too often well below effective prevention levels. The wild polio outbreak appears to have been introduced into Tajikistan from India; the strains most resemble those from Uttar Pradesh, according to genetic typing [2]. The virus found fertile ground in Tajikistan [4], an imported wild polio outbreak occurred in Xinjiang, China in September 2011 which was introduced from Pakistan [5] EPI lead to achievements and is also facing great challenge, what we learnt and what needs to be the next step?

What we learnt is the political will often weakened the disease burden and it dramatically reduced morbidity and mortality, even getting free polio vaccination program implemented. Following political will ignorance of the local government lead to inadequate financial and human resources investment. What we need to do is firstly is to know how to use the surveillance data to harness political will and overcome or mitigate the shortage of resources, and secondly how to use a selective approach to implement SIAs to focus limited resources on the highest risk areas, might be the most effective and timely way to reduce the accumulation of susceptible populations and prevent epidemics. Here is an example from Guangxi, China.

Guangxi is China's one of the five minority autonomous provincial-level administrative divisions. It is located on the southern frontier area, bordered by Vietnam to the south. The region covers more than 236,000

km² (approximately the same size as the Lao People's Democratic Republic) and has a population of 50 million (similar to South Africa, the 25th most populous country). As indicated by the region's full name, Guangxi Zhuang Autonomous Region, approximately one-third of the population is of the Zhuang ethnic group. Much of the territory is mountainous with a subtropical climate characterized by high humidity, monsoons, and long hot summers. During recent years, Guangxi's economy has been growing rapidly; however, it languishes behind many other parts of the country and is ranked 20th of the 31 administrative divisions in mainland China in terms of gross domestic product (GDP) per capita. The underdeveloped economy, multiethnic population, subtropical climate, and mountainous terrain pose great challenges for public health services, including measles control. The full name is Guangxi Zhuang Autonomous Region, a provincial-level administrative division of China. Here, we simply refer to it as Guangxi.

Design and Scope of Epi-Info

Aligning the EPI-info for measles control and elimination must take the socioeconomic setting into account: a complete and detailed description of the situation should be the first step for refinement (Table 1). The refined EPI-info in Guangxi has been designed to build a bridge between the political network outside the health sector and the public health care network, the immunization service in particular. It covers not only the biologic factors for epidemiologic intervention (ie, immunization) but also the social and organizational factors associated with inadequate political commitment and insufficient inputs from local governments (Table 2). The scope of Guangxi EPI surveillance goes beyond the conventional definition of disease surveillance that is collecting, analyzing and reporting disease data for health intervention. In addition to the case-based epidemiologic data of the targeted diseases, the EPI-info in Guangxi is more focused on resource availability and commitments from local governments, including financial and human resources, capacity and system building, and strategies and processes to improve immunization services. This refined EPI-info has the following 3 key goals:

1. Seeking resources needed: to secure political and financial commitments to developing the infrastructure of immunization services and to obtain a sustainable supply of equipment and personnel.

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2. Monitoring efficiency of performance: to monitor the performance of the immunization service, the trend of vaccine coverage, and population immunity.
3. Sustaining desired outcome: to achieve sustainable reductions in mortality and morbidity and reduce the burden of measles and other vaccine-preventable diseases.

Operational Features of Epi-Info

Documenting the situation with quantitative indicators The key feature of the Guangxi EPI-info is its capacity to quantify both the overall immunization performance of health care agencies and support from non-health related governmental departments. These quantitative indicators provide a mechanism to make cross-sectional comparisons between countries and retrospectively evaluate the progress made in any single country. It is also feasible to identify the weak links in any

local immunization service chain, as well as the geographic spots where intensive intervention, including mass immunization or advocacy campaigns, may be needed. Most importantly, by ranking countries according to their overall performance scores, the situation reports generated from the EPI-info apply peer pressure to local government leaders, motivating them to allocate the resources needed to improve immunization services.

Endorsed by the provincial governor, the situation reports exert national and provincial government influence onto local government leaders. By quantitatively linking the performance evaluations of local government leaders with the immunization service performance of his or her administration, the system mobilizes the necessary political commitment to address the deep-seated local issues associated with timely and effective provision of immunization services.

Steps	Activity
Status of problem	Measles was an endemic problem in Guangxi, particularly in the rural areas. Achieving the measles elimination by the national targeted date is not feasible with the existing EPI system, in particular, the current level of government inputs.
Understanding the setting	
<ul style="list-style-type: none"> • General physical, social, economic situation 	In addition to high birth rates and high percentage of minority population, the underdeveloped economic, the mountainous terrain and subtropical climate create various conditions unfavorable to measles control/elimination program.
<ul style="list-style-type: none"> • Type and organization of political system 	The local government leaders are appointed by the provincial government. They enjoy unchallenged power over resources appropriation, and also face political consequences for failure to address the issues identified by provincial government.
<ul style="list-style-type: none"> • Type and organization of health care system 	County public health agencies came under the leadership of the local government, while the provincial public health authority has only a technical assistance role.
<ul style="list-style-type: none"> • The weakness of the existing system 	Limited financial and human resource, high staff turnover, insufficient Infrastructure, and short of communications between health staff and politicians.
Clarify the purpose of the surveillance system	(1) Secure political and financial commitments to immunization service (2) Monitor the performance of immunization service, and the trend of vaccine coverage and population immunity, and (3) Achieve sustainable mortality and morbidity reduction and reduce the burden of measles and other vaccine-preventable diseases.
Formulate the topic and content	(1)The cases of measles including demographic and geographic information for identifying the high-risk areas for intervention. (2)Information on strategies and processes for improving immunization service, and capacity and resources for implementing these strategies.
Define the scope	Entire population with focuses on rural and minority-populated areas.
Determine how quickly information is needed	Case should be reported within 12 hours of onset. The outbreak, if more than 7 cases reported within a well-defined area, should be investigated within 48 hours of reporting. All other information is collected on needed base.
Select source of information and the method of collection	Mandatory reporting from physicians, vital-event registration, regular and periodic surveys, and focuses group discussion.
Collect the data	Data were collected by the counties public health department with assistance from provincial center for disease control.
Process and analyze the data	Case-based information was analyzed monthly (March-June) or quarterly by county EPI staff, and the summary was reported to provincial center. Other data were processed and analyzed by the provincial center on needed bases.
Interpret the data	Cases-based data should be interpreted by local staff for prompt response. Other data were interpreted by provincial staff with assistance from county's.
Write report and disseminate findings	The report with the rankings of county in order of scores was formulated by the provincial staff, and was endowed by provincial leaders, including governor.
Ensure that those who need the information receive it	Newsletters with updated epidemiological reports were circulated within the government leaders and health care professionals province-wide.
Evaluate the usefulness of data that is collected to those who use it	Political and technical authority from province periodically inspected the counties whose overall EPI performance score below 85. Official warning documents (yellow warning card) endowed by provincial political leaders will be re-sent to the county's leaders whose EPI score remained unimproved.

Note: Table 1 was created using the template presented in reference [7]; the template is titled "Steps in Gathering Information to Meet a Health-Related Objective and Their Application to Three Health Issues." EPI-info, comprehensive information system collecting data pertaining to Expanded Program on Immunization.

^aThe total number of counties in Guangxi increased from 89 in 1989 to 110 in 2007 because of the splitting of large counties into >2 small ones, because of increases in population and administrative considerations. The counties in Guangxi are diversified demographically and socioeconomically. The most populous county (population, 1.6 million) is almost 16 times bigger than the least populous county (population, 93,000). Guangxi is also known for its linguistic diversity. In the capital of Nanning, for example, 4 dialect-languages are spoken: Southwestern Mandarin, Cantonese, Pinghua, and Zhuang.

Table 1: The steps in the development of the EPI surveillance system in Guangxi^a.

	2001	2002	2003	2004	2005-6
Financial and human resources					
The salaries of all public health workers in county's department of public health are fully government-funded.	7	5	7	20	18
Budget for cold-chain ≥ 0.1 yuan/per capita	7	4	8.5	7	7
Mass immunization campaign are fully state-funded	4	3	0.5	1	1
Revenue generated from fee-for-service was retained with department of public health for sustainability of service	3	1	4	2	5
Subsidized salary to village doctors from government ≥ 30 ¥ (\$4.5)/ m	4	2	5	10	9
County EPI staff $\geq 1/100,000$ population	3	0	1.5	1	1
Township EPI staff $\geq 1/10,000$ population	4	2	2	2	2
Village doctor $\geq 1/$ village	2	0	2	2	2
County-wide EPI inspection $\geq 4/$ year	2	2	2	2	2
Capacity and system building					
An separated branch exclusively for EPI service at county department of public health	3	2	1.5	1	1
A computer exclusively operated by EPI staff $\geq 1/$ township	0	0	2	2	1
4 rooms exclusively for EPI available from all township health centers ^a	8	6	5	3	3
Professional development training for EPI staff $\geq 1/$ year	0	10	1	1	2
Strategies and processes to improve immunization services					
Well-defined action plan of measles control	12	2	7	4	7
Active and sensitive AFP surveillance	5	6	4	2.5	8
Active reporting system on major notifiable infectious diseases	0	2	5	2.5	3.5
100 % newborns with immunization registration	3	1	0	11	4
Operation of cold-chain ≥ 6 rounds / year	16	1	1	0.5	0.5
Immunization coverage obtained by survey $\geq 85\%$ ^b	3	20	16	7.5	6
Hepatic B coverage with 3 doses $\geq 85\%$ ^c	4	6	3	1.5	1.5
Catch-up immunization service for unregistered children	0	5	5	4	4
Satisfactorily documented procedure of safety injection	0	0	1	0.5	0.5
Documented procedure of vaccine and vaccination management	0	8	5	7.5	6.5
Routinely conducting education campaign on immunization service	6	5	5	2.5	2.5
EPI review and evaluation at township level $\geq 12/$ year	4	7	6	2	2
Total	100	100	100	100	100

Note: The weight of each item was reviewed and revised annually to reflect the major issues to be addressed at different stages of disease control and elimination. EPI-info, comprehensive information system collecting data pertaining to Expanded Program on Immunization (EPI).

^aOffice, vaccine store, waiting or education room, and immunization room.

^bThe province-wide professional development program on measles was initiated in 2002, requiring extra financial and logistic support for staff training programs from local governments and health agencies. The training program was successfully completed, and the weight was reduced accordingly in the following years.

^cCoverage defined as 1-dose coverage among children 1–6 years old.

Table 2: Information collected by the EPI surveillance system and quantitative weight assigned to each item, Guangxi, China, 2001 – 2006.

Identifying the weakest link in local immunization service chains and geographic spots

Epidemiologic risk factors, such as low coverage of vaccination or insufficient herd immunity, are always deeply rooted with social, cultural, and institutional factors, including low public awareness of the health issues and inadequate attention from local government. Among these factors, lack of political commitment is, by and large, the decisive factor. Since the launch of the EPI-info in 2001, 45 countries with overall EPI scores below the cutoff (80 of 100 for national-level poverty-stricken countries and 85 for non-poverty-stricken countries) have been identified as “poor performers” requiring intensive advocacy intervention, mainly owing to inadequate input from local government, including lack of political will and financial resources. National level poverty-stricken countries were designated by the State Council Leading Group Office of Poverty Alleviation and Reduction in 1994; there were 592 such countries nationwide, with an average per

capita income of 700 Chinese yuans [\$95 US] in 1994, 28 located in Guangxi. According to the most recent survey conducted in 2002 by the general investigation.

Group of Rural Areas of the National Bureau of Statistics, the per capita net income of residents in these countries was 1305 Chinese yuans [\$186 US], 58% of the national average. Further information can be obtained from <http://en.cpad.gov.cn/item/>. On their commendation of the provincial health authority, a “yellow card” has been issued to the governments of these countries by the provincial governor, alerting the local government of the weak immunization service and demanding immediate action to improve the situation.

Working closely with the key decision makers

The culture of credibility for information has been combined by EPI-info with the belief that information is collected for effective action, particularly for resource mobilization to ensure that the

technical recommendations generated from epidemiologic data are practically applicable and financially sustainable. The Guangxi EPI-info is neither a loop built into the public health system nor a machine translating surveillance data into health information for archiving. Instead, it moves one step further into the realm of influencing policy and decision making, translating “information” into “messages” and further into actions. The EPI staff in Guangxi have become adept at the art and science of communicating the surveillance messages with the stakeholders involved, and these interrelationships have been carefully cultivated, gently managed, and constantly reviewed and revised as needed. Seeking personal commitment and engagement from local government and community leaders to support measles control, and immunization services more generally, has been the top priority for senior members of the provincial EPI-info management team. Winning hearts and minds has been achieved through a series of informal round-table discussions involving representatives from the provincial health authority, local political leaders, and the directors of the public health services in those countries that received an alert card. The meetings generally start with EPI staff explaining how measles epidemics occur, the potential financial and human costs of taking no action, and the potential social and political benefits of taking action. Strategies are recommended to improve low immunization performance scores, with tailored solutions for each country.

Yellow card alerting system as core tool for policy intervention

The list of countries alerted by a yellow card (EPI blacklist) was reviewed annually. Countries where EPI services did not improve sufficiently and the overall EPI scores remained below the cutoff for their category (national-level poverty-stricken countries vs other countries) were not removed from the list, and the alerts were reissued to the local governments by the governor’s office 2 years after the first alert. The chief executive officers and political leaders of country governments are generally appointed by provincial governments, and they face consequences, such as suspension, downgrading, or even dismissal from their jobs for poor performance in implementing the agenda set by upstream governments. Being listed on EPI blacklist would heavily and negatively affect the performance evaluations of local government leaders and their administrations. It was therefore hard for these officials to ignore the alerts and not take action to address the issues associated with the provision of immunization services. As of the current data, only two countries were alerted again, both national level poverty stricken countries.

The Impact of Epi-Info

We have evaluated the effectiveness of the EPI-info and the impact of yellow card system on 3 elements of the immunization service system: resources, performance, and outcomes. Since the launch of the system in 2001, financial investment from local governments toward immunization services in the format of regular budget has increased substantially. Between 2001 and 2006, per capita funding increased by 216% in countries that had received a yellow card and by 112% for Guangxi province as a whole. Immunization service facilities (including supplies, equipment, and office or work space) have improved, and the proportion of full-time employee positions filled and supported by government funds (from regular budgets rather than fees from paid-for services) has increased significantly, particularly in countries that received yellow card warnings. By 2006, 95% of township health

centers and village immunization clinics were staffed by health care workers financially subsidized by local government, creating a solid foundation for the sustainable development of immunization services at the grass roots level. More aggressive outreach programs to identify unregistered children have been conducted by township and village health care workers to increase the coverage of measles, polio, and other vaccines. Consequently, the numbers of children registered by EPI workers has been increasing continuously: the estimated coverage of measles vaccine among 1-4 year-olds increased from, 80% in 2001 to 97% in 2006, and the incidence of measles in Guangxi province as a whole decreased by 86%, from 13.32/100,000 in 2001 to 1.87/100,000 in 2006, 0.53/ million and 0.57/1million in 2010 and 2011 respectively [6].

The principles of disease eradication are encapsulated in a constellation of four conditions: biologic feasibility, adequate public health infrastructure, sufficient funding, and sustained political/societal will. Biologic feasibility as polio free and measles elimination, sustained political/societal will is a key importance for both adequate public health infrastructures, sufficient funding based on it. Guangxi’s experience in the EPI performance worth thinking and borrowing.

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