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The Integrated Disease Surveillance and Response (IDSR) strategy was developed by the Africa Regional Office (AFRO) of the World Health Organisation (WHO) and proposed for adoption by member states in 1998. The goal was to build WHO/AFRO countries' capacity to detect, report and effectively respond to priority infectious diseases. This evaluation focuses on the outcomes in four countries that implemented this strategy.

Major successes included: integration of the surveillance function of most of the categorical disease control programmes; implementation of standard surveillance, laboratory and response guidelines; improved timeliness and completeness of surveillance data and increased national-level review and use of surveillance data for response.

The most challenging aspects were: strengthening laboratory networks; providing regular feedback and supervision on surveillance and response activities; routine monitoring of IDSR activities and extending the strategy to sub-national levels.

Keywords: capacity development; surveillance; outbreak investigation; integrated programmes

Introduction and background

By 1998, important weaknesses in national communicable disease surveillance, outbreak preparedness and public health response systems in many African countries were widely recognised. In response, the World Health Organisation's Regional Office for Africa (WHO/AFRO) proposed the Integrated Disease Surveillance and Response (IDSR) strategy as an Africa-wide strategy to strengthen public health

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surveillance and response (WHO 2000). In addition, WHO/AFRO had a key role in developing generic technical guidelines (WHO 2001a) for adaptation by implementing countries, as well as providing ongoing technical assistance and consultation.

Key goals of the IDSR strategy were the integration of multiple existing 'categorical' surveillance and response systems and linking surveillance, laboratory and other data with public health action. Whereas categorical systems may become highly effective, the multiplicity of such systems is highly inefficient from the standpoint of the Ministry of Health (MOH) and district health workers (Taylor *et al*. 1997, WHO 2000, Davey *et al*. 2006). Further, they create uneven availability and use of resources. Ironically, with few exceptions, the highly qualified trained staff, surveillance and response systems that support prevention and control efforts for the targeted disease programmes have had relatively little beneficial effect on other programmes affecting the same communities (Sutter and Cochi 1997, Taylor *et al*. 1997, Nsubuga *et al*. 2002b).

Upon adoption of the IDSR strategy each country followed common steps: an assessment of their current national surveillance and response capacity, including laboratory services and infrastructure, followed by the development and implementation of a prioritised five-year action plan.

The assessment identified gaps and opportunities for strengthening. Tanzania conducted its assessment in 1998 (Brown *et al*. 1999, Nsubuga *et al*. 2002a), followed by Ghana and Uganda in 2000 and Zimbabwe in 2003. The findings were similar in each country (CDC 2000, Nsubuga *et al*. 2002a). For disease surveillance and control there was an absence of explicit priorities; there were numerous disease-specific surveillance systems with unique data collection requirements and processes; there was a lack of awareness of standardised surveillance case definitions; delayed, incomplete disease reporting and delayed investigation of case reports or suspected outbreaks. Laboratory confirmation of suspected outbreaks was limited, and there was no systematic collaboration or coordination between epidemiology and laboratory units. Analysis of surveillance data was limited, as was systematic surveillance feedback and supervisory visits from higher to lower public health system levels. There was a low level of preparedness to respond rapidly and effectively to outbreaks; inadequate resources for communication and transportation to support surveillance and response and insufficient training at all levels.

A prioritised five-year national plan of action was then developed to address the activities required to integrate and coordinate surveillance and response (WHO 2001b, McNabb *et al*. 2002). Each country, with AFRO assistance, then adapted the generic WHO/AFRO technical guidelines for surveillance and response and training modules to accommodate their national objectives and public health system environment (WHO 2001a, 2003).

In 2002, a three-year Interagency Agreement (IAA) was developed between the US Agency for International Development (USAID, who contributed to the development of implementing strategies as well as provided substantial funding support) and the US Centres for Disease Control and Prevention (CDC) to provide technical support for IDSR implementation in Ghana, Uganda, Tanzania and Zimbabwe (CDC and United States Agency for International Development 2002). CDC then created the Global Surveillance Project (GSP) to implement the agreement.

In that same year, each of the four GSP countries began receiving the additional funding and technical support provided for in the IAA. This support included

training in field epidemiology and related topics in each country and funding for Master of Public Health (MPH) students to participate in outbreak investigations conducted by the MOH, as well as for additional university and MOH staff to assist in implementing selected aspects of the IDSR strategy. Further, GSP, working with the staffs of the host countries' MOHs and universities and other CDC units, provided assistance in the development of the technical guidelines and epidemiologic capabilities of MOH human resources as well as for their implementation.

For 3 years, Ghana and Tanzania also received support from Partners for Health Reform *plus* (PHR *plus*), a USAID-supported project that assisted with IDSR implementation in eight (7%) of 110 districts in Ghana (Government of Ghana 2002) and 12 (11%) of 114 in Tanzania (Eisele *et al*. 2006). IDSR guidelines and orientation and training materials for use throughout each country were developed, focussing on developing specific competencies needed to support implementation of their plan. Further, in 2002 the Ghana MOH received United Nations Foundation funding for a three-year project to strengthen integrated disease surveillance of vaccine-preventable diseases and linked this effort to their IDSR strategy (WHO 2005a).

IDSR implementation in Ghana and Uganda led to the definition of job descriptions for district disease surveillance officers and district laboratory coordinators. However, during implementation, staffing the positions was difficult due to both the limited availability of trained personnel and of funding. As a result, the duties were often assigned to current staff in addition to their pre-existing duties and responsibilities.

Methods for evaluation of the integrated disease surveillance and response (IDSR) implementation

This evaluation was designed to identify accomplishments in each of the four GSP countries and the lessons that could be learned from the experience. Three major IDSR components were identified for evaluation: epidemiologic surveillance and response; related public health laboratory services and the educational infrastructure that produces trained public health manpower. A guide was then developed to address these components, utilising core IDSR indicators developed collaboratively by WHO/AFRO, selected African countries and CDC (WHO 2006). The evaluation was conducted between June and August 2005. It included reviews of project documents and a site visit to each of the four countries to interview the principal persons involved and review selected reports.

Key informants (KIs) in the epidemiology units of the Ministries of Health, the laboratories and the respective universities were interviewed. The questions asked of each group were identical in most instances, although in a few (noted below) there were some minor differences reflecting the principal contributions of the informant. The same set of interview questions was used in all four countries, in the same way and in the same order. All interviews were conducted by two of the authors (Groseclose and Brown). In most instances the interviews were with an individual informant, however, there sometimes were two informants in the same interview. For all positive or affirmative answers the respondents were asked to provide copies of appropriate documents (e.g., outbreak investigation reports, surveillance reports, laboratory data and evaluation findings). The questions addressed were:

(1) In what ways have you routinely monitored implementation of your Plan of Action?
(2) What are the most important differences in the way the epidemiologic surveillance and response system/central and extended laboratory system works now compared to pre-IDSR, at the health facility, district, regional and national levels? What have been the most important benefits? (This was not applicable to university interviews.)
(3) What are the most important links to forge between epidemiology and laboratory practices/the university and the epidemiology and laboratory organisations that employ your graduates? What are/were the benefits of doing so?
(4) What were the important contributors to your successes? To restraints on successes?
(5) What is your assessment of the training in epidemiology and laboratory services provided to the MPH students (for MOH informants)? Of the professional development needs of the MPH students for them to properly support achievement of the MOHs disease prevention and control objectives (for university informants)?
(6) Who are your partners in this process, what are their roles and how would you like to see your relationship with them develop over time?
(7) What inputs to this programme have been made by persons at higher levels in the organisation? What makes this programme important to them?
(8) In what ways would you like to strengthen this programme? What is critical to sustaining this programme? What are the risks to this programme?
(9) What are your expectations and recommendations regarding future external and internal funding? How can continued funding be assured?
(10) What advice would you give to other countries considering implementing a programme having goals similar to yours?

Results

During the field visits to each country, a total of 56 KI interviews were conducted, mainly at the national level, ranging from 9 to 20 per country. By discipline, 53% of the KIs were epidemiologists and surveillance staff members, 28% were school of public health staff, 13% laboratory technicians and 6% health management information system (HMIS) staff. While most of the MOH staff interviewed were from the national level, some were from sub-national levels. Some of the obstacles to including more were their availability, the time required to travel to district sites and the impossibility of getting a representative sample in a realistic period of time. Limited quantitative data, in the form of previous studies, evaluation reports or epidemiology bulletins, were available.

Epidemiologic surveillance and response

Priority diseases for surveillance and response varied by country based on endemicity and the public health system's capacity to intervene. For example, while meningococcal meningitis had epidemic potential and was included among the priority conditions in Ghana, Tanzania and Uganda, it was not endemic in Zimbabwe and

was not included there as a priority disease (see Table 1). All four countries required case-based reporting for measles, neonatal tetanus and polio. Summary reporting was used for other priority diseases and represents the total number of cases by disease by time period (e.g., per week or per month). The ability to collect either case-based or summary data within the IDSR framework not only supported the unique data needs for some disease control programmes (which facilitated integration), but also allowed the same data source to seamlessly report different data for different conditions within the same surveillance infrastructure.

Following the selection of priority diseases, standardised case definitions were developed, distributed and reviewed during training sessions. During non-outbreak periods, the laboratory-confirmation status of cases reported at the national level was usually not differentiated due to the delay in receipt of laboratory results and the inability to link the laboratory report with the corresponding case report.

IDSR implementation re-emphasised the value of surveillance data, and many important changes resulted (see Table 2). Each country, for example, was encouraged to track its data by monitoring the timeliness and completeness of weekly and monthly morbidity reporting. Providing feedback on these surveillance attributes, even irregularly, resulted in more consistent and complete data collection and reporting and improvements in surveillance data quality (see Figure 1).

Another important development occurred in Uganda, where the MOH began publishing weekly disease morbidity data in a weekly nationally distributed newspaper. Publication costs were high, but feedback indicated that national and sub-national political and technical leaders became aware of the data and frequently inquired about the data presented. As improved data quality stabilised, in 2002 and 2003, it revealed high measles incidence (3000–5000 reported nationally each

Table 1. Common IDSR priority diseases or health conditions by country and reporting frequency, 2005.

	Frequency of reporting to national level		
Priority disease/condition	Immediate	Weekly	Monthly
A. Adopted by all four countries			
Neonatal tetanus[a]	G	T, U, Z	G, T
Polio[a]	G, U	T, Z	G, T
Measles[a]	G, U	G, T, Z	G, T
Bacillary dysentery	U	T, Z	G, T
Cholera	G, U	G, T, Z	G, T
Diarrhoea children <5 years		U, Z	G, T
Malaria		U, Z	G, T
B. Adopted by three of the four countries			
Meningococcal meningitis	G, U	G, T	G, T
Yellow fever	G	T, U	G, T
Plague		U, Z	T
Rabies		T, U, Z	T

[a]All four countries also established case-based reporting for this condition.
Note: G, Ghana; T, Tanzania; U, Uganda; Z, Zimbabwe.

Table 2. Characteristics of IDSR surveillance systems, by country, as of July 2005.

Characteristic	Ghana	Tanzania	Uganda	Zimbabwe
Standard surveillance case definitions implemented	Yes, 2002	Yes, 2001	Yes, 2001	Yes, 2002
Differentiation of suspect and confirmed cases reported to national level	Incomplete, not standardised	Same as Ghana	Same as Ghana	Same as Ghana
Evidence of defined alert and action/ epidemic thresholds to guide response	Yes, guidance provided by national level	Same as Ghana	Same as Ghana	Same as Ghana
Outbreak monitoring system functional	Yes, restricted to outbreak reports investigated by MOH staff	Same as Ghana	Yes, MOH log book	Yes, outbreak log used irregularly
Community-based surveillance conducted	Yes, especially for Yellow Fever and guinea worm	No	Yes, developmental	Yes, village health workers trained to report suspected outbreaks
District-level surveillance coordinators	Yes	Yes, 100%	Yes, 100%	?
Generic data analysis guide developed and disseminated	No, developmental	Yes, 2002; ~25% of districts received guide and training	Yes	Yes
Evidence of routine data analysis at the district or regional level	Yes, limited	Yes, limited to 12 districts in which PHR *plus* introduced IDSR	Yes, limited; estimate 10%	Yes, limited
Evidence of routine data analysis at the national level	Yes, weekly epidemiology bulletins; weekly MOH disease control and lab meetings	Yes, weekly discussion of surveillance data in MOH meeting	Yes, weekly discussion of surveillance data in MOH meeting	Same as Ghana
Routine monitoring of reporting timeliness and completeness	Yes	Yes	Yes	Yes
Routinely disseminate surveillance data	Yes, weekly bulletin, irregular production and distribution dependent upon resources	Yes, routine weekly and monthly morbidity reports disseminated by MOH	Yes, weekly epidemiological newsletter; weekly notifiable condition reporting in national newspaper	Yes, weekly report

Table 2 (*Continued*)

Characteristic	Ghana	Tanzania	Uganda	Zimbabwe
Routinely disseminate outbreak investigation findings	Reports drafted, not disseminated	Generate outbreak investigation reports but distribution is not defined	Generate outbreak investigation reports but distribution is not defined	Yes, periodically outbreak investigation information included in weekly report
Generic feedback guide for districts	No	Yes	Yes	No
Evidence of regular feedback to lower levels	No	No	No	No
Evidence of use of surveillance data to guide response	Yes, outbreak detection followed by investigation	Yes, some districts designating increased case reports as indicative of an outbreak	Yes, outbreak detection followed by investigation	Yes, outbreak detection followed by investigation
Evidence of use of surveillance data to guide planning/policy development	Yes, used for preparedness planning and resource provision in areas experiencing seasonal increases in cholera and for defining need for human capacity development	Yes, used for preparedness (ensuring emergency stocks of drugs and supplies); improved malaria and diarrhoeal disease control programme management in 12 (11%) of 114 districts	Yes, surveillance conducted before and following measles vaccination campaign demonstrated reduced incidence and vaccination effectiveness	Yes
Core indicators for national and district monitoring of IDSR implemented	Yes, limited number of indicators implemented and limited number of districts participating	Yes, limited to PHR *plus* districts	Yes, used in two evaluations	Yes, developed for district and health facility levels
Priority diseases re-evaluated since IDSR implementation	No	No	No	No

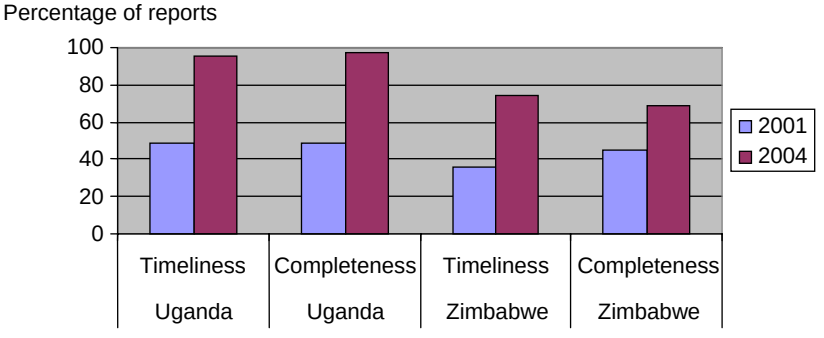

Figure 1. Timeliness[a] and completeness[b] of weekly surveillance reporting, Uganda and Zimbabwe, 2001 and 2004.

[a]Timeliness was defined as the number of districts that submitted weekly reports each week over the 52 weekly reporting periods.

[b]Completeness was defined as the number of districts that submitted data reported from their health facilities each week over the 52 weekly reporting periods.

week) – clearly illustrating a public health problem. Uganda's MOH subsequently conducted a mass vaccination campaign targeting affected populations in October 2003. Surveillance data reported after the campaign revealed dramatic declines (approximately 200 cases per month) in measles incidence (see Figure 2).

Improvements in surveillance data quality led directly to an increased data management burden in each country. Several respondents reported the need for additional data management expertise. The response also led some of the countries to purchase varying kinds and amounts of computer hardware and software intended to assist with data management and analysis activities, but this information technology equipment was often poorly utilised due to the limited information technology expertise among public health system staff.

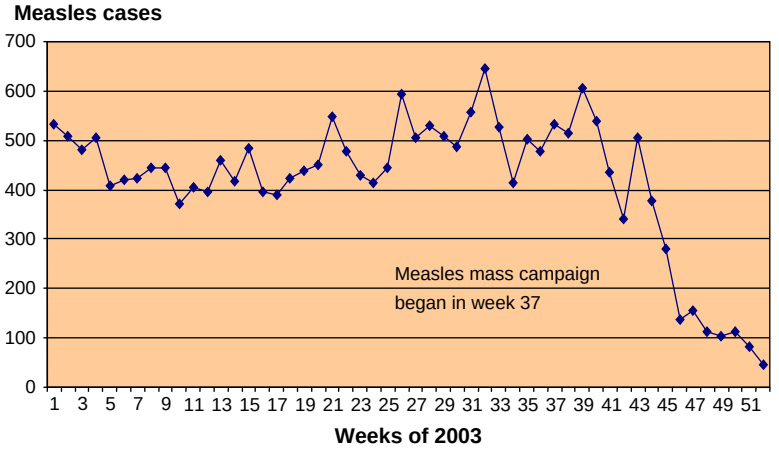

Figure 2. Weekly reports of measles cases prior to and following a national mass vaccination campaign, Uganda, 2003.

While respondents reported improvements in each of these surveillance processes as a result of IDSR implementation, some activities (e.g., generation or dissemination of weekly surveillance bulletins) had been achieved that could not always be sustained. Further, none of the four countries had integrated the surveillance and response activities associated with HIV/AIDS, tuberculosis and leprosy prevention and control programmes into the overall IDSR framework.

Outbreak response teams with defined membership and operational protocols were established in each country at the national level (see Table 3). Sub-national teams were established in some districts in each country, but the coverage was limited.

While most outbreak documentation reflected the work of national level MOH staff, school of public health students, who are largely MOH employees, were important members of the response teams in Ghana, Uganda and Zimbabwe, and were often responsible for documenting the outbreak investigation and findings. The MPH programmes in the participating countries take part in field epidemiology training where trainees are taught to provide epidemiologic service as part of their training. In Uganda, MPH students generated 10–15 outbreak investigation reports each year, between 2002 and 2004; and Zimbabwe published an internal report summarising disease outbreaks, 'Disease Outbreak Summary, 2002–2005'. Each country had a system for monitoring outbreaks and their characteristics but the systems were maintained irregularly.

Public health laboratory services

Early steps towards strengthening the laboratory's role in surveillance and response included adapting and disseminating selected laboratory standard operating procedures, establishing stronger laboratory networks and strengthening working relationships between the laboratory and disease surveillance units at national and sub-national levels (see Table 4). Some training was provided in each country to support implementation of these steps.

Each country reported the ability to confirm selected priority conditions and test for antimicrobial resistance, but the level of the laboratory network that could confirm these conditions varied and was found mainly at the national level. Some districts had local access to laboratory services while others had to transport specimens to regional or more distant laboratories, often leading to poor specimen quality due to inadequate handling, storage and transportation.

There was evidence of laboratory reporting to support IDSR in Ghana, Uganda and Zimbabwe, though respondents reported difficulty in linking laboratory and disease surveillance data due to delayed reporting and inadequate documentation. Laboratory staff members were explicitly members of each national outbreak response team, but laboratory participation on district response teams was not consistent (only Uganda reported routine involvement of district laboratory staff on district response teams) – often due to incomplete laboratory networks, especially the absence of trained laboratorians.

Numerous outbreak reports documented the limited availability of specimen collection supplies and reagents to support surveillance and response. Even so, respondents in each country reported an overall increasing trend of collection, referral and testing of specimens for confirmation. In 2005, Uganda reported that

Table 3. Characteristics of IDSR laboratory services by country.

Characteristic	Ghana	Tanzania	Uganda	Zimbabwe
Lab guidelines and standard operating procedures developed	Yes	Yes, 2003	Yes, 2003	Yes
Laboratory and specimen handling guidelines distributed	Yes	Yes, limited	Yes, 2003	Yes
Laboratory and specimen handling training provided to clinical and public health laboratories	Yes, limited	Yes, limited	Yes, limited	Yes, limited
IDSR laboratory steering committee defined and functioning	Integrated with National Surveillance Unit (NSU)/ MOH	No	Yes, actively participated in tailoring guidelines and Standard Operating Procedures (SOPs)	No
Ability to confirm selected priority diseases	Yes	Yes	Yes	Yes
Monitoring of antimicrobial resistance of selected organisms	Yes	Yes	Yes, district/regional hospital labs	Yes
Evidence of functional laboratory network	Yes, three zonal (public health sub-regions) labs and national Public Health Reference Lab; improved communication network	Equivocal, 17 regional, three zonal labs in MOH lab network for service planning; no evidence of lab reporting to support public health surveillance	42% (24/56) of district labs participating in lab network (reporting, communication)	Twenty-eight district sentinel labs report to national level
District level laboratory coordinators	No	No	Yes, 82% (46/56 districts)	Yes

Table 3 (*Continued*)

Characteristic	Ghana	Tanzania	Uganda	Zimbabwe
Laboratory participation in surveillance and response	Yes, national response team participation; developed IDSR laboratory action plan, 2004	Yes, national response team participation	Yes, district and national team participation; lab data reported every fourth week in MOH weekly epi bulletin	Yes, established National Microbiology Reference Lab (NMRL) supports IDSR confirmatory testing of epidemic-prone diseases; has lab surveillance and response officer; periodic publication of lab test results in weekly epi reports
Availability of lab reagents and supplies for specimen collection and transportation	Variable	Variable	Variable	Variable
Ability to transport specimens for testing	Limited due to resource constraints	Same as Ghana	Same as Ghana	Same as Ghana
Regulation of clinical labs	No	No	No	No
Registration of clinical lab staff	No	No	Yes, 'Allied Health Professions Statute'	No
Lab quality assurance or proficiency testing programme	Yes, incomplete participation; the Public Health Reference Laboratory participates in WHO proficiency testing programme	Yes, unknown level of lab participation	Yes, incomplete participation	?
Laboratory assessment conducted post-IDSR?	Yes	Yes, in 2005, by National Institute of Medical Research	Yes, 2004; monitored districts submitting specimens for outbreak investigation in last 12 months	Yes, monitored: completeness of weekly reporting from district labs; timeliness; percentage of labs with accurate results supplies

Table 4. Characteristics of IDSR outbreak response and epidemic preparedness by country, as of July 2005.

Characteristic/attribute/criteria	Ghana	Tanzania	Uganda	Zimbabwe
Outbreak response teams established at the national level	Yes	Yes	Yes	Yes
Outbreak response teams established at sub-national level(s)	Yes, in many districts	Same as Ghana	Same as Ghana	Same as Ghana
Laboratory participation in outbreak response	Yes, at national level	Same as Ghana	Yes, at national and district level	Same as Ghana
School of Public Health/Applied Epidemiology Training Programme student participation in outbreak investigations	Yes	Limited	Yes	Yes
Supervision and monitoring visits conducted at lower levels	Yes, in meningitis zones. Assess preparedness (e.g., supplies, forms); periodically conduct post-outbreak follow-up visits to districts	Yes, in 12 PHR *plus* districts	Yes, incomplete. Moving to 'Area Team Concept' for monitoring, evaluation and supervision	Guides under development for supervisory visits to districts and HCFs
Evidence of epidemic preparedness activities (e.g., monitoring of surveillance and response supplies)	Yes, M&E visits to meningitis-prone districts	Yes, funds given to MSD for outbreak response vaccines, drugs, fluids, etc.		
Evidence of case management directed by surveillance findings?	Yes, use of antimicrobial resistance test results to influence case management (Meningitis)		Same as Ghana (Cholera)	Same as Ghana (enteric bacterial pathogens)

24 (43%) of its 56 districts had submitted specimens for outbreak investigations in the past 12 months. During the same period, laboratory testing confirmed 20 (61%) of 33 suspected cholera outbreaks reported for which specimens were submitted, 14 (61%) of 23 suspected dysentery outbreaks, 14 (78%) of 18 suspected meningitis outbreaks and four (67%) of six suspected typhoid outbreaks.

Uganda, Ghana and Zimbabwe specifically mentioned the usefulness of antimicrobial testing to guide case management, often allowing the MOH to recommend the use of first, rather than third, generation antimicrobials for priority conditions. An episode occurred during the evaluation team's site visit to Uganda that exemplifies this. In recent cholera outbreaks Ugandan epidemiologists identified a shift in the causative agent, from *Vibrio cholerae Ogawa* to *V. cholerae Inaba*. Further, antimicrobial resistance testing indicated that the *Inaba* isolates were resistant to the standard recommended antimicrobial therapy. The MOH responded by preparing a press release to inform District Medical Directors of Health Services and health care providers of the change in cholera epidemiology and the need to modify the recommended treatment based on susceptibility testing. Additionally, the national outbreak response team was mobilised to investigate the outbreak associated with the most recent isolation.

Educational infrastructure

In Ghana, Uganda and Zimbabwe, developing and using locally available epidemiologic capacity was facilitated through collaborating with the field epidemiology training programmes affiliated with the Public Health School without Walls project (Tanzania did not have a comparable programme). Funded by Rockefeller Foundation with technical support from the CDC and WHO, these organisations have been sustained for many years (Beaglehole *et al*. 2001, White *et al*. 2001, 2006, Nsubuga *et al*. 2006). They were designed based on the US Epidemic Intelligence Service, and provide field-based epidemiology and public health management training.

The schools of public health in each country expressed willingness to continue to support the training needs of the general public health system through their PHSWOW MPH programmes; and, more importantly, a desire to expand their role in provision of workforce training specific to IDSR via in-service training or other mechanisms. And the schools, in fact, were an important part of the answer to this need. In Ghana, for example, the university collaborated with the Ghana Health Service in designing and conducting training at the district level.

Discussion

While IDSR is a work in progress it is strengthening systems and workforces in African countries. Adoption and implementation of the IDSR strategy provided a framework for revisiting their surveillance priorities and objectives and plans of action. Other valuable contributions included: explicit linkage of surveillance and public health investigations; increased efficiency resulting from integration of surveillance systems and processes; increased emphasis on the role of district public health teams in response, and the definition of their needs; integration of epidemiological and laboratory activities and data; epidemiology, laboratory and workforce capacity

building and strengthened partnerships between categorical disease programmes, laboratories and the public and private health care sectors.

The public health process and system changes and their geographic and population coverage varied widely by country. This is largely a result of limited personnel and resources, workforce turnover, competing priorities and inconsistent domestic and international leadership.

Implementation of the IDSR strategy in these four countries directly led to improved data collection, reporting, analysis and monitoring and strengthened the culture of data use for decision-making at the national and sub-national levels. Several respondents reported that prior to IDSR, outbreaks were often handled 'politically' due to concerns regarding the potential social and economic implications, which is an important barrier to transparent domestic and global reporting and response (Cash and Narasimhan 2000). Suspected outbreaks are now more widely recognised as public health events that require investigation and response by the health sector. Epidemiological data and methods were increasingly well-utilised by surveillance and response teams at district, regional and national levels for outbreak detection and response. Unfortunately, there was little evidence that these data were used by higher level technical and political leaders to prioritise and plan more effective prevention programmes and to allocate resources for improved prevention. This remains an important challenge.

Involving schools of public health, which train using a field-based approach, was a successful strategy and also led to improvements in the schools' own capability for public health workforce capacity development. The IDSR partnerships are helping move countries towards meeting the new International Health Regulations, which call for improved national capacity and transparency by 2007 (WHO 2005b).

Translating the IDSR implementation experience of these four countries to other countries is subject to at least four limitations. First, the information in the evaluation was self-reported by interested parties (however, this is significantly offset, we believe, by the high level of consistency of responses among the KIs, who worked in diverse settings and organisations and countries). Second, the evaluation findings are largely qualitative in nature and alternate sources for independent validation were limited. Third, few quantitative comparison (e.g., before, after) measures of the surveillance and response processes were available. Fourth, there was limited information available on the coverage of IDSR below the district level, a consequence of both our collection of data at the national public health system level and the limited monitoring and evaluation data reported from lower levels of the public health system, and possibly the effect of initiation of IDSR from the national level downwards.

Conclusions and recommendations

Because IDSR is a WHO/AFRO-wide strategy, it is important to distil lessons learned:

- First, involve partners and stakeholders in the initial and subsequent assessments of surveillance and response organisation, resources and practices and in the development of a common action plan that defines roles, responsibilities and timelines to address public health priorities and objectives. The countries' leadership, ownership and full partnership were crucially important.

- Second, establish a national MOH Advisory Committee responsible for oversight of and advocacy for implementation of the IDSR strategy. The Committee should meet regularly to monitor key IDSR performance indicators to provide guidance regarding response to emerging issues and allocation of resources, as well as to ensure a continued focus on integrated strategies that promote IDSR and its goals.
- Third, initiate routine monitoring and evaluation of IDSR performance indicators prior to and throughout the IDSR implementation process.
- Fourth, strengthen and systematise the interchange of surveillance and outbreak investigation findings between public health system levels and between public and private sector stakeholders.
- Fifth, partner with academic and training organisations to increase the public health workforce and to provide effective, ongoing professional development for the current workforce. Where possible, use competency-based applied epidemiology training programmes, e.g., field epidemiology training programmes. Graduates, staff and students of these programmes should be used to train lower-level health workers, using field-based, impact-oriented methods that provide measurable effects in the short term as they build capacity (Nsubuga *et al*. 2006, White *et al*. 2006).
- Sixth, strengthen clinical and public health laboratory networks and maintain linkages between laboratory and epidemiology staff at all levels of the public health system. Confirmation of suspect cases is necessary for appropriate case management and outbreak response.

Experiences such as this evaluation reveal the uncertainties of planning assumptions, the timing and amount of resources needed and available, political will, the time and effort required to change some things and other factors. This evaluation and manuscript casts light on many of these and on their sum and serves to alert others to the complexities of planned change even in such a circumscribed area as disease surveillance and control.

Since the time of this assessment, IDSR implementation has continued in each of these four countries and has begun in several others on the African continent. In view of the time since the evaluation, one can question whether the assessment data are still useful. Interestingly, the data, lessons learned and recommendations noted above, have remained useful in both situations. While the data describing the then current status of disease surveillance and response in these four countries may no longer be reliably descriptive, they have turned out to be an accurate predictor of what to expect in countries that newly undertake to strengthen their systems through implementation of the IDSR strategy – their initial status, priority setting and planning needs, anticipation of resource needs and implementation issues, and managing change.

Thus the data, lessons learned and recommendations have been invaluable in informing ministries of health as to realistic expectations and developmental methods.

That these six recommendations arose directly from the experiences of the four countries, and further are sound from the standpoint of epidemiologic practice and developmental work generally, attests to their appropriateness. With the increasing requirements for timely and effective disease and outbreak detection and control,

including the WHO's new International Health Regulations, and resources being made available for improving public health in Africa, the question of using these effectively and efficiently, always important, is now in the forefront. It is important that the countries using these resources use developmental models that are not only technically sound but grounded in their own realities.

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