Post-Disaster Surveillance in the Philippines: An External Review of the SPEED Program

15 July–10 August 2012

William E Keene, PhD MPH
Portland, Oregon (USA)
keene@epilinks.com

INTRODUCTION

I was invited to conduct an external review of the SPEED[1] surveillance system operated by the Department of Health of the Philippines. The external reviewer was accompanied and facilitated by Dr. Aura Corpuz (WHO/Philippines) and Dr. Peter Mala (WHO/HQ), both of whom were instrumental in the design, nurturing, and implementation of SPEED over the past 2 years.

The purpose of the review was to describe the system, assess its stated purposes, and determine the degree to which SPEED as currently implemented meets those purposes. We reviewed the capacity of the system to provide an early warning and response to epidemic prone diseases. To the extent possible, we reviewed SPEED per international standards in terms of the basic attributes of a surveillance system including its coverage (both geographic and demographic), and the flexibility, acceptability, and sustainability of the system.

We were also asked to evaluate the extent of and potential for integration and coordination of SPEED with other routine DOH surveillance systems, specifically PIDSR[2]. Finally, we were asked to make recommendations for maintenance and improvement of the SPEED system.

Methods

We reviewed SPEED program documentation, including training materials, forms, software, code books, internal program reviews, and the like. Descriptions of previous SPEED deployments were reviewed. We discussed the design and development of the database, its web interface, and the SMS reporting method with its chief architect. We reviewed the SPEED web site.

Semi-structured or open-ended interviews were conducted with key informants selected by WHO-Philippines staff. Interviews were typically informal and conducted face-to-face with multiple individuals simultaneously (e.g., CHO epidemiologist and staff). Informants were identified based on availability and willingness to participate, and primarily came from offices with experience with SPEED following disasters (i.e., not those with experience only in trainings and exercises). Most interviews were conducted with public health staff, but we also met with one private hospital administrator and her staff, as well as several political leaders. Two interviews were conducted by telephone municipal-level HEMS coordinators.

Depending on their level of involvement, informants were asked to describe previous SPEED trainings (both received and given) and technical issues with data collection, collation, transmission, and summarization. We discussed the quality and availability of training materials and other supplies, and their participation in other surveillance programs (e.g., PIDSR), if any. We explored their understanding of the relationship between SPEED, PIDSR, and other surveillance systems, and how they could and should be coordinated. Those with prior “real-life” experience with SPEED were asked about that experience, including their subjective impressions of the program and their suggestions for improvements. Where available, sample records were reviewed. Political leaders were asked about the utility and sustainability of SPEED locally.

[1] Surveillance in Post Extreme Emergencies and Disasters
[2] Philippine Integrated Disease Surveillance and Response

DOH and WHO staff had previously conducted after-action evaluations of SPEED pilot programs and post-disaster operations (e.g., tropical storms Sendong, Pedring, Quiel); these reports were reviewed.

We were able to observe portions of the planned national Simulation Exercise held in July 2012 and (unfortunately) also the early stages of SPEED activation during the unplanned disaster of August 2012, i.e., the flooding in Manila and elsewhere subsequent to heavy rains and Typhoon Gener.

The offices that we were able to visit and the persons we interviewed are listed in Appendix 1.

Limitations of the Review

The primary limitations of this (or any) external review fall into several categories. First, it takes some time to begin to "get up to speed" on any country's public health system in general and the surveillance system in particular, much less who all the players are and their respective roles and interests. The exuberant use of acronyms is a source of some confusion and amusement to the newcomer. This learning curve is particularly steep when there is only one newcomer (i.e., everybody else knows each other and "where the bodies are buried."). That said, WHO staff and others have been most helpful and forthcoming, and the reporting categories of the system are mechanically very similar to other WHO-fostered surveillance systems that are familiar to the reviewer.

Second, it was not feasible to review primary records (e.g., individual case or alert logs) in any detail. Thus, any real estimation of sensitivity or specificity was infeasible and we were left with only anecdotal impressions from those we interviewed.

Third, for logistic and other reasons, the selection of key informants was left to the organizers. There is nothing wrong with that, and no realistic alternative, but consciously or subconsciously this could bias the impressions. Group interviews also make it potentially more difficult to hear unfettered criticism, particularly for persons in lower job categories in the presence of more senior persons or those who worry about giving offense.

Finally, there was no way to independently verify information provided by informants; representations were accepted at face value.

DESCRIPTION OF THE SYSTEM

Public health importance

The history of the Philippines suggests that the country will continue to confront natural disasters and other emergencies that affect the health of its people. Earthquakes, volcanoes, typhoons, landslides, flooding; all are recurrent risks in the archipelago. As a large, densely populated country—and an international hub—the Philippines is also at risk for the introduction or (re)emergence of epidemics of pathogens both familiar (e.g., dengue, leptospirosis, cholera) and novel (e.g., SARS, avian influenza, Nipah). Disasters and other emergencies can displace populations, disrupt normal public health functions, and impose new public health challenges. In these situations, there can be an urgent need for surveillance data to monitor the incidence of communicable diseases and other conditions that the public health

system must respond to. Accurate and timely data can help decision makers efficiently deploy limited resources and minimize morbidity and mortality.

Purpose of the system

To quote from the excellent documentation, “Surveillance in Post-Extreme Emergencies and Disasters (SPEED) is an early warning system designed to monitor diseases (both communicable and non-communicable), injuries, and health trends, that can be harnessed as a powerful tool by health emergency managers in getting vital information for appropriate and timely response during emergencies and disasters.

SPEED has the following objectives during extreme emergencies or disasters:

1. Early detection of unusual increases or occurrences in communicable and non-communicable diseases and health conditions;
2. Monitor health trends; and
3. Enable identification of appropriate response.”

SPEED was designed for limited and temporary use and then only under certain circumstances. It is meant to be an adjunct to other, more routine surveillance systems, not a replacement for them. Moreover, SPEED is not only a program for reporting, it is intended to provide a framework for response. SPEED may also help the Philippines meet its obligations for surveillance and response under the International Health Regulations (IHR) of 2005.

Resources used to operate the system

SPEED is operated by the Health Emergency Management Staff (HEMS) within the DOH and by HEMS coordinators in Regional, Provincial, and local governmental units. A variety of physical and human resources were required to develop and deploy the system, and are likewise needed to maintain and operate it.

Startup costs included the overall planning and design of the system, the development of the requisite database and associated software, including the SMS data entry interface, and the preparation of training materials, forms, documentation, and marketing materials. Deployment costs primarily comprise training programs, including associated travel.

Funding for the development of SPEED and initial trainings was primarily provided by international donors (primarily AusAID, with some contributions from USAID and Finland) through the WHO country office.

The direct operational costs of SPEED are astonishingly low. These include maintenance of the virtual server (<US$600/year), the SMS text charges, which are discounted some 99.5% (<US$2000/year), and the modest replacement costs of consumable forms, marketing, and incentive items.

The marginal labor costs are difficult to calculate. These would include time lost to training and associated travel, including any practice exercises. As trainings are cascaded to lower levels, the number of people involved and the associated costs increase. The direct costs of front-line worker trainings are typically borne locally.

When SPEED surveillance is active, expenses will include the time to tabulate and transmit daily reports at the reporting unit level, the time to validate reports (typically

at the Municipal or City Health Office [MHO/CHO] level), and the time taken to review and analyze data and to prepare any necessary reports. These costs are distributed across all levels of the public health system and are not directly reimbursed. There are also the costs of responding to any alerts or other SPEED-derived triggers, including “false alarms” or low-risk events.

For agencies that have used SPEED in actual disasters, the estimates of the time necessary to prepare the daily report at the primary level varied considerably, from “a few minutes” to “half a day.” Some variation is to be expected based on case load, experience, and other factors, but variation of this magnitude seems excessive, and one wonders if this resulted from a conflation of SPEED-related activities with those of PIDSR or other surveillance efforts or some other misunderstanding. This is not an unimportant point (see below) and I regret that we have not been able to clarify this. It does not seem like preparing the daily report should take an experienced person even 1 hour.

The costs of the system may be offset by savings from increased efficiency in the deployment of human and physical resources and from reduced morbidity and mortality. These savings are potentially large—possibly even larger than the entire cost of SPEED—but are largely external and at this time cannot be readily calculated. Consequently, SPEED is best viewed as a humanitarian or social welfare program rather than a “cost-saving” initiative per se.

Coverage

SPEED is a contingency early warning surveillance system designed to provide morbidity (and to a limited extent mortality) data in the event of a disaster or other health emergency. As of July 2012, it was available for immediate rollout nationwide. All Regions of the Philippines have received basic training in how the system works, and all Regions participated in the recent (July 2012) SPEED Simulation Exercise with reasonable success. The relatively few LGUs with “real life” experience using SPEED would undoubtedly be better able to implement SPEED again in future without much hand-holding, but the subjective impression is that HEMS coordinators and other persons in all areas were well oriented to the system and would be able to facilitate going live on very short notice. Indeed, the largest single deployment of SPEED to date (following tropical storm Sendong in 2011) occurred reasonably efficiently in an area that at the time had had *no* orientation or prior training.

SPEED is explicitly designed to cover a limited number of conditions—primarily communicable diseases of particular concern in emergency situations. SPEED is not intended to replace “regular” disease reporting (e.g., PIDSR), although one can imagine large disaster scenarios where the relatively resource-intensive PIDSR might go down and SPEED be the only system operational for a time. SPEED captures data in relatively simple syndromic categories that can be used by people with relatively little medical training. Some of the case definitions clearly are intended to correspond to specific diseases of epidemic concern (e.g., measles, leptospirosis, tetanus), but as indicated on the forms, few of these syndromes are pathognomonic. The range of conditions included seems appropriate to the Philippines and for IHR surveillance.

SPEED reporting units include potentially any health facilities providing primary care down to the barangay health station, including evacuation centers and other

temporary facilities that may operate following a disaster. Although the emphasis to date has been on training for government facilities, in an emergency reporters ideally would also include private hospitals, NGOs, and other facilities operated by the military, international, or other agencies.

The SPEED database has a hierarchical access model, meaning that local officials can see all data from within their municipality; provincial officials everything within their province; and so on. Users at the national level can see everything (and, if I understand it correctly, can also edit everything—a potential problem). As data are added (either by SMS uploading, manual keypunching, or other mode), they become immediately accessible to higher level users. There is a validation step that must occur before new numbers get added to the "official" counts, but unvalidated messages are visible. Validation occurs at the local level by the MHO/CHO, with a fail-safe provision for validation at the provincial or national level should there be an undue delay locally.

The system is programmed with algorithms to trigger automatic "alerts" should case counts exceed specified thresholds. Alerts should prompt additional investigation, including where possible laboratory testing. Some low-frequency, high-significance conditions trigger alerts with only a single case report (e.g., [suspect] measles, leptospirosis, acute flaccid paralysis, tetanus, malnutrition), while other clustering or sustained increases over baseline trends. There are no international standards for where these trigger points should be set, and for most diseases they are arbitrary. The alert thresholds that were chosen seem to be reasonable starting points, but they should be periodically reviewed; there is nothing magical about them.

SPEED also allows users to send manual alerts about specific disease conditions, although as implemented the marginal utility of this feature is not clear. A single case of tetanus, for example, is enough to trigger an automatic alert by algorithm; but it would appear that the user is also supposed to send a redundant alert message saying, in effect, "I have a case of tetanus." SMS is robust, but not necessarily the preferred mode for sharing and discussing complex information. SPEED activation obviously does not preclude front line staff from simply picking up the telephone or otherwise making *ad hoc* inquiries—even by SMS if necessary—to relate developments of interest or concern, and in many circumstances that would be preferred.

SPEED is currently operated by DOH under its general mandate to protect the public's health. Work is underway on an Administrative Order that will give additional and more explicit legal authority to the Department to direct all health care facilities (public and private) to comply with SPEED reporting should a state of emergency or calamity be declared.

Activation/Deactivation

As a supplemental system for use in emergencies, SPEED is not "normally" in use in any given area. The great majority of health care facilities in the country have never used SPEED except in training exercises. Over the past 2 years, there has been considerable discussion of the indications for activating and deactivating SPEED. General principles are set forth in the documentation, but the decision is ultimately (and appropriately) individualized to the situation at hand. Any disaster should be followed by a rapid assessment that would cover at least these factors: the potential

for large numbers of displaced persons, the actual or potential disruption of normal medical and preventive health services, and the likelihood of increased environmental risks among affected populations. Another way of approaching the decision is to ask the simple question: would SPEED data be useful in the management of the disaster, and would that potential utility outweigh the marginal costs of operation? If the answer is yes, then activation is indicated.

According to the documentation, even the MHO can activate SPEED once a state of calamity has been declared locally. In practice, it is expected that any activations would result from collaborative discussions with all levels involved. The IT infrastructure for SPEED is always turned on, so as a practical matter one can begin to submit reports by SMS or any other mode at any time with no advance notice. Obviously there is little point to activation until there is a plan to aggregate review the data as they become available. There are political considerations to activation, however, and it would be ill-advised to activate without consultation with the appropriate authorities.

SPEED can be activated immediately following an event (e.g., within 48 hours), although there is no intrinsic harm to delayed activation other than delayed benefit. The ease of activation and deactivation effectively lowers the threshold for activation, as there are few adverse consequences for “premature” activation.

Triggers for deactivation were thoroughly explored in the draft 2010 Field Manual and in contemporary discussions, and include the return of disease patterns to pre-disaster levels, significant reductions in the number of displaced persons, closures of evacuation centers, substantial control of extraordinary environmental risk factors, and the restoration of most normal medical and preventive health services. Curiously, however, the final version of the Manual (July 2011) omits this discussion, reducing the decision to only two criteria:

1. When there is an official declaration that the emergency is over *or*
2. When the conditions that warrant SPEED activation no longer exist.

The discussion in the 2010 draft seems more helpful, but in any event, it is hoped that deactivation decisions would be reached by consensus. Such decisions must be communicated immediately to all reporting units; apparently that has not always happened—with predictably irritating result.

There has been active discussion about activating SPEED during non-disaster situations (e.g., the present cholera outbreak in Catanduanes). SPEED has the advantages of daily reporting with a relatively light footprint that can be “dropped in” without much preparation. This may be appropriate where regular surveillance is poor or the situation may be rapidly changing, but it will require coordination among the consumers of these data.

Training

A variety of training materials have been produced that by all accounts and appearances are well suited to the task. These include manuals, flip chart packets, and an interactive training video being distributed on DVD and flash drive. All users we talked to were quite satisfied with the quality and quantity of training materials. There is a nice packet of simple laminated training materials that is available for

primary reporters. We could not assess how widely these materials have been disseminated or retained.

The responsibility for cascading training to the lowest levels rests with the LGUs, and to minimize costs and lost work time such training would be done in concert with other scheduled activities. SPEED is not unduly complicated and front-line workers should not take more than 2–4 hours to become sufficiently "expert"—at least until they forget about it. The take-home materials provide a good refresher for those with the time and interest.

Software Architecture and Implementation

SPEED uses a custom database that is centralized at the national level. Access to the database is through a thin-client browser interface, with read and write privileges contingent upon one's login and position in the reporting hierarchy.

The web site (*http://speedsurveillance.org*) is simple and straightforward. The tables, graphs, and maps that can be generated are well done. Export functionality is very good. The reviewer's experience has been that the web pages typically load very slowly (based on multiple connections from LGUs, hotels, and the WHO office) to the point of exasperation, but this has not been unique to the SPEED pages. LGU users frequently reported difficulties with both network and broadband dongle wireless connections.

According to the designer, the SPEED platform is built in mySQL, PHP, and AJAX. PHP and mySQL are open-source standards that we were told are commonly used by DOH programmers in IMS. It was not clear if IMS staff have had the chance to analyze the SPEED code yet and are ready to take this on now.

SPEED System Attributes

We considered the basic attributes of SPEED as a surveillance system under the criteria of an accepted review standard.[3]

Simplicity. Non-alert SPEED data are very basic, consisting of daily case counts for the various syndromes. Case counts are subdivided into two age categories with counts for the number of cases and the number of deaths in each category. There are provisions for reporting through a number of mechanisms, including manual (delivery of paper), phone, fax, internet, and—perhaps the marquee feature of the system—SMS. Standardized codes allow users to use basic technology to report. Once the report data are generated, reporting itself should rarely take >5 minutes. All in all, it is a model of simplicity.

That said, while the SMS system seems straightforward, on day 1 of the recent Simulation Exercise 212/1637 messages received (13%) were invalid for one or more reasons; by day 2 still 119/1362 (9%). The most common errors were invalid disease codes or invalid data (e.g., improper spaces or punctuation).

Flexibility. The system is flexible in some ways and constrained in others. At the central and IT levels, it is easy to make modifications such as adding or deleting notifiable syndromes, modifying case definitions, or adding new reporting facilities.

[3] CDC. Updated guidelines for evaluating public health surveillance systems: recommendations from the guidelines working group. MMWR 2001;50(No. RR-13).

New analysis and reporting features can be readily added because the database is centralized.

The task of submitting reports is extremely flexible. While the current expectation is that SMS would be the preferred modality for most users, one can also send paper reports via runner or lateral hand-offs to neighboring jurisdictions, or can submit by phone, fax, or internet. Training should emphasize that the concept that SPEED is a surveillance system, not an SMS message system. Data submitters may have to use their ingenuity to get reports in, particularly in post-disaster situations when regular communications may be disrupted. Future exercises should not be so SMS-centric; leave the choice of reporting modes to the user. In the July exercise, for example, many would-be reporters were unable to connect by SMS due to network capacity issues. Many tried repeatedly to SMS before giving up, but "success" might have been better measured by how were able to get messages in by any mode; this would be a more valuable measure of flexibility in action.

One impediment to flexibility stems from the significant investment in printed materials and other hardcopy training materials that would become "dated" were several types of changes made. For example, most training materials refer very specifically to the "21" reportable conditions, and adding or dropping a condition would change that number. Tweaks to case definitions or reporting routes would have a similar effect. This is perhaps inevitable wherever lack of routine internet access, computers, and printers makes it impossible to rely on as-needed soft-copy training and reporting materials. In future editions of these materials, it would be good to emphasize that the specifics of the system are always subject to change....

Data quality. We were unable to independently assess the quality of the data collected. Bear in mind that SPEED is not usually in use, so the only real data would be from the several post-disaster activations. There are certainly errors made in transmission, but many common errors are caught by the system and soon queried. The manual validation that is required catches some less-obvious errors too.

Duplication is always an issue with de-identified data. Since SPEED is essentially a record of consultations, it would be easy for someone to visit a facility on 3 successive days with the same complaint of diarrhea or respiratory symptoms and be counted 3 times—or, as was reported anecdotally—for displaced persons to visit multiple evacuation centers even on the same day—"shopping around" to see who was passing out the best goodies. It was stressed that "evacuation centers" are not necessarily residential units—even temporarily—and estimating their "population size" can be harder than it would seem. (One observer recommended counting at night to get the most stable numbers.) This is more of a problem when using case counts to identify outbreaks, but discrepancies can also distort assessments of the need for medical supplies, health care workers, and the like. There is no ready solution to this problem, but experience can help mitigate its effects.

Syndromic data are inherently crude, and the information needed to distinguish between overlapping case definitions will not always be available. Although informants uniformly stated that the case definitions "made sense" and were easy to follow, at least one experienced informant freely acknowledged that all the clinical information needed to distinguish some of the categories was often not recorded in registry books, and thus misclassification could be common for some syndromes.

Overall, one must maintain a healthy skepticism towards even “verified” SPEED data. Data for some relatively uncommon and relatively distinctive syndromes are likely to be of better average quality than data for diarrheal disease or ARIs. That said, one is reminded of the admonition the perfect can be the enemy of the good”; however imperfect, the quality of SPEED data may be quite adequate to their purpose.

Acceptability. Among the people we talked to, the acceptability of SPEED was very high, indeed, often enthusiastically so. People at all levels who had used SPEED thought that it was easy to use and played a valuable role in public health.

The documented history of the SPEED program makes it clear than an extraordinary effort went into identifying and involving stakeholders from all levels at early stages of its development. Multiple meetings were held to solicit comments and debate different models. This no doubt went a long way towards ensuring its feasibility for the Philippines as well as “buy-in” by all involved.

Although there are exceptions, efforts to involve private sector hospitals in routine disease surveillance (e.g., PIDSR) have had only mixed success. LGUs reported some success in actual emergencies enrolling local private hospitals in SPEED, and in Cagayan de Oro and Iligan City private hospitals reportedly have been among the most consistent of reporters. The issuance of the relevant Administrative Order will presumably facilitate the acceptance of SPEED in both public and private secotrs. Although not yet tested in the Philippines, in large-scale disaster relief operations elsewhere in Asia most NGOs and international operators have willingly participated in WHO-facilitated disease surveillance programs, and I would anticipate similar or even better acceptance of SPEED in those sectors should the occasion arise.

We talked to several political leaders who were somewhat less familiar (or in 2 cases quite unfamiliar) with SPEED, and they were more noncommittal about the budgetary and other implications of the program, deferring to local public health officials about its merits. This is to be expected, but illustrates the need to continue marketing efforts that extend beyond the public health community.

Sensitivity. Again, without an (infeasible) review of primary data, it is impossible to calculate sensitivity. Given the general lack of specificity to most case definitions, it could be predicted that sensitivity for individual case reports to be counted would be relatively high—assuming, that is, that reporting is complete and accurate—an assumption that we could not verify. Sensitivity is also affected by the health care seeking behavior of affected populations. In the current cholera outbreak in Catanduanes, for example, it was reported than many residents are reluctant to seek medical attention for whatever reason (limited access, cost, cultural norms). In some disaster situations we see almost the opposite situation; surrounded by temporary health care facilities operated by a multiplicity of organizations, people often seek medical care more often that would have been the case before the disaster struck.

As for the sensitivity of SPEED for detection of outbreaks, that is a somewhat different question, albeit also difficult to measure. To a large degree it depends on one’s definition of “outbreak." Outbreak detection sensitivity is undoubtedly higher for etiologies with more distinctive syndromes and lower alert thresholds. Outbreaks of disease with multi-etiology syndromes (e.g., diarrhea, cough) would be easy to miss until the number of cases becomes high enough to drive total numbers into alert

territory. On the other hand, absent sophisticated laboratory testing, small outbreaks of common pathogens that cause few deaths (e.g., non-typhoidal *Salmonella*, norovirus, *Campylobacter*, rhinoviruses, influenza) are unlikely to be identified under the best of pre-disaster circumstances, meaning that, from an emergency management perspective, missing small outbreaks buried in SPEED data is not a significant problem. The algorithms for alert notification are set on the sensitive side, though, so the problem is on balance more likely to be on of specificity rather than sensitivity.

Positive predictive value (PPV). The predictive value of a positive signal is a function of specificity and prevalence. Absent laboratory testing, PPV is likely to be low for most alerts, at least when asking questions such as “does this cluster of reports reflect a common-source or person-to-person outbreak of xxxx?” This may be less of a concern to emergency management staff than to communicable disease epidemiologists. If there are ample resources to follow up on all alerts, including laboratory testing, and follow-up is relatively easy and inexpensive, there is little problem to a low PPV. If the system is stressed, however, as may be the case, this becomes more of an issue, and managers at all levels will have to be more flexible in determining the appropriate degree of response.

Representativeness. If reports are collected from all primary care locations within the affected areas, SPEED data are likely to be highly representative. If, on the other hand, there is more complete reporting from, say, government sites compared to NGOs or private hospitals, there is a potential for bias. It seems most likely that any such bias would be relatively unimportant for outbreaks of any size.

Timeliness. The only thing better than daily reporting (the SPEED standard) would be real-time case reporting from a fully electronic system. The wireless access for health project being piloted in Tarlac is a step in that direction, but it may be years before that potential can be realized. When it is, it should be possible to abstract both PIDSR and SPEED-type summary reports directly from those patient records, and indeed the need for SPEED would presumably decline. Even at present, however, the timeliness of SPEED reporting is excellent. Even if a daily report is missed, “old” or batched reports can be submitted as communications are restored. One- or two-day old reports are still much better than the once-a-week standard that is more typical of EWARN-type systems—although frankly the value of “real-time” syndromic surveillance tallies (as opposed to *ad hoc* alerts) is probably overstated.

Stability. Insofar as SPEED is designed to be turned on and off as warranted by post-disaster circumstances, stability is best assessed in terms of system sustainability (see below).

Observations of the National Simulation Exercise

During the nationwide SPEED exercise conducted on 17–19 July 2012, we observed activities at the HEMS Operations Center at the DOH/Manila and regional and local activities at selected locations in Region IV-A (Rizal) and Region X (Northern Mindanao). Supervisors, data managers and surveillance officers, and reporting nurses and midwives were interviewed about their experience with the exercise.

In general the exercise went well, or at least better than expected. (Attempted) participation rates were high at the provincial level, reaching 100% in many areas,

particularly on day 3 (at least at provincial levels). Unfortunately, predictable technical issues in Manila may have given a misleadingly poor impression of the system's capability to some participants at the lowest levels (i.e., the relatively low participation rates on days 1 and 2 appeared to reflect mostly connectivity issues rather than any lack of effort). At the Regional office we visited, surveillance officers assured us that they had contacted 100% of the ostensibly "non-reporting" sites and been assured by all that they had attempted to report but been unable to do so because of network issues.

As one goes below the Provincial level, however, participation rates appear to fall precipitously. Some of this may well reflect the same technical issues, but it sounds like there may have been some ambiguities in the scenario instructions that led to confusion about who was expected to participate.

It was understood by the organizers before the exercise began that an artificially high number of reporters (~1500 nationwide) could tax the system, and unfortunately that fear was realized. SMS reporters reported frequent difficulties getting message confirmations, which resulted in a cycle of attempted reports that increased the burden on the system to the point of a crash.

In an actual disaster, it is anticipated that there would typically be <50 SPEED reporting sites and virtually always <100. According to the system architect, the system was designed to allow for up to 200 users, and in simulations has handled up to 300. It was explained that the basic limitation is on of post-processing of the SMS message, which imposes a number of program calls that in the aggregate are time consuming and can overwhelm the server. It is likely that further optimization of the code or perhaps queuing some of the post-processing could obviate this problem for data submitters with a minimal performance hit for consumers (e.g., internet database data might not be live, but rather depending on load delayed by some minutes). Whether it is worth "fixing" this self-induced problem is open to question. Alternative strategies for future exercises (e.g., conducting exercises for only one or two regions at a time; staggering recommended reporting times throughout the day) might obviate this problem at little or on cost. Given that a simultaneous national exercise is essentially a demonstration for the convenience of the Center, these might be the preferred alternative, with the ancillary benefit of imposing less of a burden on HEMS staff in Manila and allowing for a more individualized evaluation of the training response(s).

Understandable as it may be now, the experience was obviously frustrating to all concern, and has the potential to undermine confidence in the system among lower level participants. It is imperative that the post-exercise debrief address this issue and that the discussion be disseminated to all levels. "Sorry guys, it wasn't your fault...."

The other issue brought up by virtually all exercise participants was incompatibility with or lack of access to the Globe mobile network, as coverage varies around the country. According the IT consultant, the ideal solution (a single number that would work with all networks, with routing to be determined by the sender's mobile network) may not be possible, and the solution of giving out 2 or 3 numbers—one for each major network—is not as simple as it might sound. The problem is well understood and under consideration.

The Operation Center at HEMS appeared to be very well staffed with trained persons who were facilitating local reporting (or at least confirming that local problems were nothing that could be fixed in the short term). There was considerable enthusiasm for the exercise, not only at the national office but all the way down to the barangay health workers we met.

From our limited vantage point, the focus of the simulation exercise seemed to be on the mechanical process of getting SMS reports to the server. There was little discussion and at several locations seemingly little awareness of the charge to take the aggregated exercise data, analyze them, and prepare a plan of action accordingly. We were shown one simulation exercise response plan from Tarlac that appeared to be competently executed, and perhaps that was more common than it seemed. In any event there needs to be an ongoing effort to strengthen the ability to analyze and respond to the surveillance data.

Notes on the August 2012 Flooding Disaster (Monsoon/Typhoon Gener-related)

The unfortunate flooding that has affected at least 31 provinces in 6 regions, including Metro Manila, provided an unscheduled opportunity to see SPEED being activated in a real disaster. On 7 August, there were 34 reporting sites; on 8 August, 55; and on 9 August, again 55 (albeit not exactly the same ones). It was not very clear to anyone I spoke with what those numbers “should” have been—i.e., it was not possible to calculate or even estimate what proportion of health facilities and evacuation centers in the affected areas were reporting or should have been reporting or would have been reporting if they had anything reportable. This is a significant management problem that needs to be addressed. Sites that are enabled but not reporting need to be asked about their reasons for not reporting and those issues addressed as quickly as possible.

The Operations Center at DOH was operational the entire time, despite minor flooding in the DOH compound. The backup Operations Center at East Avenue Hospital was also activated.

Although not much of great import had happened by day 4 (this reviewer’s last day in country) because of SPEED reports specifically, several issues (single cases of AHF, AMN, MEA) had been reported and had been referred for routine follow-up. There had been none of the issues with internet or SMS access seen during the Simulation Exercise in July. Although unavailable at this writing, the after-action review of SPEED’s operation and utility during the August 2012 flooding will provide another important “reality check” for the system.

According to the HEMS staff at DOH, some of the templates for situation reports and other materials that had been created for use the in time for the National Exercise in July were proving very useful now, and obviously the recent practice had helped people get going quickly.

CAPACITY OF THE SYSTEM

Sustainability

Sustainability includes multiple components, including the long-term availability of technical, financial, and political support.

Decisions need to be made about the IT components of SPEED. While the SPEED software is already created, it will require maintenance as problems are identified, other related systems change, or new features are needed. DOH has the option of retaining the long-term assistance of outside IT consultants or getting the staff in IMS to take over this role. If the latter, they will need to ensure that in-house staff have or acquire the necessary skills and the time to learn the system inside and out. It is not clear that either option is currently budgeted. It would appear that the developer is currently being expected to donate his time indefinitely, which seems unrealistic. The system also depends on maintaining and improving the telecommunications pipeline for SMS reports, which no doubt has its own complexities.

Although a server box was apparently bought for hosting at DOH, it has never been used. The cost of hosting this database offsite on a virtualized server is cheap, however (~$600/year), and at this point there is no obvious reason to ever migrate to an onsite server. The offsite hosting company (currently a US-based firm, InMotion) offers 24/7 support and high reliability at modest cost. This should be considered a "mission-critical" service, which means that any hosting server would need to be able to offer a high availability rate (>99% uptime) and round-the-clock technical support. It would still need to be mirrored elsewhere offsite to ensure reliability in the event of a disaster affecting metro Manila and the DOH compound itself. At this point it would seem that the server purchase may not have been necessary.

Part of sustainability is maintaining interest in and appreciation for the system. HEMS and WHO staff appear to have done an excellent job of educating not only public health staff but other stakeholders about what SPEED is and what it can do. The social marketing aids (T-shirts, clocks, and other "advertisements") are an accepted and inexpensive way to keep awareness at high levels. Reports like the SPEED In Action newsletter help explain how the program works in real life and what some of the benefits can be. DOH and WHO information staff need to continue efforts to interest the mass media in stories about SPEED. It's an award-winning government program that is relatively cheap, effective, and helps people in need: what's not to like? SPEED is not the only public health story, of course, and it is not even the main story about disease surveillance, so this success needs to be portrayed in the larger context of DOH initiatives.

The political sustainability of SPEED is difficult to for this outsider to assess. It looks well established and seems to enjoy broad support within DOH. That said, the project has been nurtured since its inception by WHO, and that support is ending in October 2012. The current Director of HEMS has been a stalwart champion of the system, but has announced plans to retire in 2014. The initial SPEED trainings have apparently reached a high proportion of municipal, provincial, and regional public health staff, but will the enthusiasm (and concomitant budgetary support) continue as the burden shifts to devolved provincial and municipal levels?

Expandability

Many observers of SPEED have raised questions about what else it could be used for. Could it be used to collect daily maternal and childbirth mortality data? Immunization data? It is tempting to say yes. After all, it would seem that one need only add some new disease codes and the same system that you've already paid for can start to provide real-time data about any number of conditions.

Some caution is indicated before making significant changes in the scope of SPEED. SPEED was designed with a relatively narrow mandate and “mission creep” could jeopardize its stated purpose.

First, there are potential technical issues. While it is easy to add new codes for new conditions and to tabulate those case counts, the SMS reporting was designed to have a certain capacity. As the recent exercise demonstrated, it is not robust enough to handle high-volume daily reporting. Presumably one can modify the system to allow for higher volume regular use, but that may require significant revisions to the existing code and at some point a different database model may be necessary.

Second, there are training issues. A considerable investment has been made in printed materials and a video that emphasize the “core” purposes and mechanics of SPEED. If one moves away from that original vision, the training materials will need to be revised, perhaps considerably.

Third, there are issues with who would be involved in running such a hybrid system. At the primary care level, SPEED reporters and PIDSR reporters are often the same person. That is still true at the municipal level, but as one goes up the ladder there is a divergence between HEMS coordinators and disease surveillance officers, not to mention others who are concerned with maternal and child health issues, chronic diseases and other non-communicable disease problems, etc. Many data of great interest to public health are not necessarily priority issues in post-disaster emergency management. There must be clear lines of responsibility for the response to surveillance reports. So long as that remains unambiguous, you should feel free to experiment, but significant expansions in scope should be piloted with caution.

A distinction should be drawn between the use of SPEED for expanded purposes and the use of a SMS-based reporting platform for other surveillance needs. There is no conceptual barrier to using SMS reporting for any number of conditions, and once could create any number or parallel databases for other purposes. I would recommend caution about embedding a broad reporting mandate into SPEED itself. In the near term this could certainly be done (with limited scope) in one or more pilot schemes, but doing something like this permanently demands careful consideration. Were parallel systems to be set up, the role (if any) that HEMS would play in maintaining them would have to be determined, as this would quickly begin to fall outside the emergency management sphere. Even were HEMS to manage the mechanics of the reporting network, the responsibility for monitoring and using those data would likely lie elsewhere (e.g., the National Epidemiology Center [NEC] for communicable disease issues).

Meeting the Stated Objectives

The 3 principal objectives of SPEED are the early detection of “unusual increases or occurrences of...health conditions” (e.g., outbreaks and other signal events), monitoring of health trends, and the identification of appropriate public health responses to same. How well are these objectives attained? With the limited number of SPEED deployments this question cannot be answered definitively.

Several clusters have been flagged quickly by SPEED reporting, including leptospirosis in Mindanao that led to a community-wide prophylaxis campaign, high numbers of wounds that led to tetanus anti-serum being deployed, and so on. If

there are a lot of false alarms, however, that may represent a lot of wasted time. We could not find a comprehensive list of alerts and the responses thereto, along with the final dispositions of these incidents that could be used to assess the number of false alarms or how much effort went into responding to these alerts. We can anticipate that certain disease clusters would have a good chance of being detected relatively early, notably those with relatively specific syndromic definitions (e.g., acute hemorrhagic fever, meningitis) that have a low background incidence. High incidence, low specificity conditions (diarrhea, coughs and colds) are likely to result in mostly false alarms. WIthout aggressive use of (limited) lab resources, these are going to be low yield categories. All that said, it must be kept in mind that SPEED is fairly inexpensive, and thus it doesn't take too many success stories to pay for itself.

Data trends are graphically displayed on the web site and the raw data can be easily exported for other analysis. "Trends" can be misleading if the raw data include mixes of apples and oranges. Intra-reporting site consistency is helped by the fact that at any given reporting site, only a small number (e.g.,1–2) of people would typically be involved in abstracting case records for the daily summaries. Thorough training helps address the issue of inter-site variability, although it cannot be eliminated entirely. It is worth pointing out that there is a real potential to obscure trends as data are aggregated. Higher level users need to keep in mind that access to larger data pools does not mean that they should only be analyzed in the aggregate; those with better epidemiological training need to keep an eye on local developments too. In more affluent countries, sophisticated laboratory subtyping would typically be used to assess clusters, but that kind of analysis is not affordable or sufficiently timely in the Philippines.

Using SPEED data to trigger appropriate public health responses is, of course, the whole point, and there is anecdotal evidence to suggest that it has done just that. Even the absence of certain actions is potentially an efficient use of limited resources. The biggest gap here is the (apparent) lack of consistent documentation about what was done or not done in response to SPEED data, both alerts and trend data. Without being able to review such records, it is not possible to make concerted judgments.

SPEED and PIDSR

There is an obvious need to understand the relationship(s) between SPEED and the more established, "routine" surveillance for communicable diseases, which includes both weekly reporting of notifiable conditions (via PIDSR) and their institutionalized alert system that include daily monitoring of internet and news media sources. At first glance they seem like two systems trying to measure (mostly) the same thing, i.e., the occurrence of various communicable diseases and outbreaks within the community. One system (SPEED) is relatively simple and intended to provide an instant overview, while PIDSR is more deliberate and collects data of higher "quality" (in terms of specificity, primarily).

PIDSR is a typical multitiered reporting system based on individually identified case reports classified as confirmed, probable, or suspect. The PIDSR Manual of Procedures (March 2008) describes a very comprehensive system with weekly

reporting[4] from all health care facilities, including private hospitals and barangay health stations. Required follow-up to case reports include validation, supplemental interviews, and laboratory confirmation as indicated.

Although it has not been a significant issue, we should note that in major disasters, PIDSR would not cover patients seen in evacuation centers, or temporary facilities operated by NGOs or foreign government agencies or the military; in theory SPEED would be activated in all these venues.

Questions have been raised about how comprehensive PIDSR is in practice, and anecdotal information would suggest that while coverage in some areas is very good, in other locations and in the private sector coverage is less comprehensive, mostly involving de facto sentinel sites. Under the devolved public health system the primary responsibility for collecting, collating, and analyzing these data lies with local and provincial authorities, and lack of resources or competing priorities will inevitable affect the quality of this or any disease surveillance.

Almost all SPEED alerts concern communicable disease syndromes, and inevitably the expertise of epidemiologists and their allies in environmental health and the laboratory is going to be needed to determine the degree and the nature of follow-up. HEMS is well positioned to provide logistic support in response to early warning signs, including provision of medicine and other supplies, but the primary role of HEMS should be to sound the alarm for potential communicable disease events being notified through SPEED; the job of responding to those events must be shared with (or handed off to) colleagues in epidemiology, environmental health, and other programs to come up with the most effective response. (It should be noted that as one gets closer to the primary care level, the HEMS coordinator, surveillance officer, and the epidemiologist increasingly tend to be the same individual.)

At this time it does not seem feasible or desirable to try to combine the two systems. There is a real distinction between surveillance based on individual named case reports and that based on summary numbers that cannot even be reduplicated. That said, they should be able to peacefully coexist. With SPEED now moving well beyond its pilot phase, it would be desirable to make more of an effort to better evaluate the predictive value of SPEED alerts and to see what value they add to PIDSR reporting, if any. This is an epidemiological research project that would take some effort. Do alerts represent epidemiologically coherent problems? Can adequate laboratory and epidemiological follow-up be brought to bear on these alerts, and what are the results? Do we learn something useful that we do not see with PIDSR data alone? Does the presumably better timeliness of SPEED compensate for the presumably lower lower signal:noise ratio?

If there is a certain lack of enthusiasm for SPEED data among NEC staff, it may be in part because of lack of access and experience. As I understand it, NEC staff cannot routinely login and review raw SPEED data.

RECOMMENDATIONS

The minutes of SPEED meetings and reviews back to 2010 indicate that the strategic underpinnings and mechanics of the system have been thoroughly vetted

[4] including zero reporting, i.e., routine reports from all facilities even if no notifiable case during the week

against Philippine and international norms for emergency management and post-disaster surveillance programs. Not surprisingly, then, it is difficult to find many fields that have been left unplowed. Overall, SPEED is a very impressive program. Thus, if some of these recommendations or criticisms seem “minor,” it is because they are. These recommendations include those ideas that occurred to me during the course of this brief review, and while I hope that they merit at least some brief consideration, no doubt those with more experience with SPEED will find some of them unrealistic (or perhaps already incorporated but apparently unappreciated or unnoticed by the reviewer).

Any surveillance system should be as complex as it needs to be to achieve its purpose, but no more so than absolutely necessary. Experience suggests that simplicity is a much more valuable attribute than comprehensiveness. The SPEED system is relatively lean, but there is still fat that can be trimmed. As experience continues to accumulate over the next several years, there should be regular reviews of all parts of SPEED to identify unnecessary detail and complexity that could be trimmed. A number of the following suggestions could go into the queue for SPEED 2.0. Anything that makes the system work faster and easier will save valuable time for people on the front lines, some of whom may (correctly?) think that they have more important things to do in a crisis situation.

Age and Mortality Categories. This reviewer is unconvinced of the utility of asking four questions about every disease condition rather than 2, or even one. Knowing the age distribution of cases is obviously of great epidemiological importance, but the categories used (0–4; 5+) are so crude as to be of little value for the initial flash report. If the number of cases is of sufficient interest to raise any concern or to trigger an automatic alert, then a more complete and useful age distribution should be assessed in the follow-up. Again, the question is not whether the age distribution of cases is important, but whether it is really necessary to capture these 2 categories (only) in the initial SPEED notice. If the answer is no, one could cut the number of routine report numbers in half, speeding both data abstraction and transmission.

Similarly, one must question the utility of collecting death data in SPEED. Deaths are indeed a valuable index of severity in disease reporting, but again, that is not the issue. Although we could not assess this in the Philippines, experience elsewhere suggests that both the specificity (deaths actually due to the reportable condition) and sensitivity (proportion of actual deaths from that condition reported) of death reports in EWARN-type rapid surveillance systems is very low. Deaths occurring in the community or not on the initial day of presentation are likely to disappear (e.g., if someone presents with meningitis on Monday they may be counted as an incident case, but may not be counted (again) as a death were they to die on, say, Wednesday). There are many other possible anomalies. For example, in South Sudan, hospitals did not count deaths that occurred within 24 hours of admission because they were “not our fault.” Perhaps those kinds of data quality issues do not apply in the Philippines, but this reviewer is very skeptical of rapid death data. Again, the issue is not whether mortality data *per se* are valuable, but whether—given their likely quality—death data from SPEED reports are worth the effort. If not, one could cut the number of report numbers in half again. One could add a generic question to the report: “Were there any unusual deaths?” and, if yes, ask for a free-text explanation.

I suspect that reporting just a single total case count for each condition would provide >95% of the value and would greatly simplify reporting, not to mention making it feasible to collect a broader range of conditions. If this is too radical a suggestion, wait a year or two and then revisit it in the light of more experience.

Case Definitions and Reportable Conditions. The disease categories should be revisited periodically and conditions dropped (or added) as indicated. For example, what is the value of collecting fracture information (FRS)? How many have ever been reported, and under what circumstances would these reports be actionable by emergency managers or epidemiologists? (Bear in mind that SPEED is unlikely to be active during the first 48 hours of any disaster when most fractures would occur.) The thinking should not be "could this possibly be useful?" but more "do I really need to have these data to quickly identify outbreaks and manage other health emergencies?" If not, get rid of it.

There are currently 6 codes for various febrile syndromes. Most of them look reasonable, but the distinction between FEV (fever) and FOS (fever with other symptoms not listed above) seems too subtle for quick and dirty reporting; I would recommend collapsing them into one condition (e.g., "any other disease with fever"; "other unexplained fever"; something like that, perhaps adding a time element (e.g., fever persisting > xx days).

Consider adding a category for suspect typhoid if that is a significant concern in emergency situations.

As currently defined, ARI includes anyone with a cough, a cold, or a sore throat. This is such a broad category that real clusters of pertussis, pneumonia, or almost anything of interest might well be lost in the fog. The broad category may be of less value that one or two much more specific conditions (e.g., pertussis, pneumonia).

In contrast, I would consider splitting animal bites into snake bites and other animal bites. Both are significant sources of morbidity and mortality in the Philippines; they should be easy to tell apart from the medical records, and they would seem to have very different implications for emergency management and risk assessment.

Several case definitions could be simplified. Any time one says "...with or without X" one is saying that X is irrelevant. For example, "Yellow eyes or skin with or without fever" means the same thing as "Yellow eyes or skin." Several conditions have this useless "with or without" language. Use the simplest definitions possible. This can be fleshed out in trainings, but the formal definitions should be as simple and "clean" as possible.

The definition of hypertension (≥140/90) seems ambiguous. Do both systolic and diastolic pressures have to be elevated? How about 145/80? 130/95? Consider simplifying to "diastolic > 90" or something like that.

The definition of WBS on the form is ambiguous. It sounds like open wounds are required plus either bruises or burns. Or is it any one of the three? I can't tell. In any event, I am somewhat skeptical of the utility of this category (or categories). Is there enough demonstrable value in the post-emergency phase to justify keeping it?

Does CON (conjunctivitis) require eye itchiness and redness or just one of the two? The comma does not answer this burning question.

Simple key fields. This will be contentious, and it is probably too late to be reconsidered, but the health facility codes that were adopted are unnecessarily long and complex and thus time-consuming to enter and relatively error prone in use. It was recognized in the SPEED Operations Manual for Managers (p.23), that "it is best to keep the Health Facility Code short so as to minimize errors when sending SMS," but in practice this sound advice was ignored. There are only ~3000 or so sites, and the simplest and probably best thing would have just been to number them 1, 2, 3, ..., 3000, 3001, ... If you are really compulsive you could make it 0001, 0002, 0003. Even shorter would be a 3-letter code ("ABC, XYZ"), which would yield over 17,000 unique possibilities. Instead there are codes like ARMMLDS001B, 3TAR001R, etc.—much too long and complicated. It is counter-intuitive to many people, but it is generally preferable to use "meaningless" key fields in database design. The other information—what region it is in, the province, the type of facility—just like its name and location—all that should go into other specific data fields, all of which will be at your fingertips when the short and simple code is entered. There is no more reason to embed all this information into one field than there is to combine a person's age, sex, name and address into one field.

This general rule could be bent (but doesn't necessarily need to be) if the authority to generate new codes for newly registered health facilities is delegated to lower levels, making necessary a way to keep these lower offices (e.g., regions or provinces) from assigning the same key to different facilities. You could do that by affixing a unique one- or two-letter prefix for each region or province (e.g., A22, K234, etc.) Even easier, just set up an online site where authorized people can go and take new numbers as they are needed. Numbers increment by one as they are claimed. Once ID numbers or codes are assigned to health facilities, they should never be changed or reused. Registering a new site could also probably be done by automated SMS, whereby one would submit the name and description of a new facility and get a reply with the centrally assigned HF code.

This issue of health facility codes is complicated by the apparently recent recognition that the National Statistics Office within the DOH already had created a set of unique facility codes that DOH is supposed to use. That may be unfortunate, but nothing that a simple translation table that would be easy to develop couldn't fix. Ideally everyone would convert to a simple numerical system, but there is no intrinsic problem with sites having 2 or 3 identity codes. So long as they are all unique they can be automatically translated as necessary. I would try to keep the SPEED codes simple and short.

The printed facility code books seem unnecessary to this reviewer—nothing that wouldn't be easier to create, update, and use in a database or even an Excel spreadsheet. At the lowest levels where computer or internet access may not be available, all the necessary codes (e.g., everything within the municipality) would easily fit onto a single piece of paper no matter what system you use. The instructions for how to register a new site could be printed on each sheet. All this should be on the web site (see below).

Reporting Forms. I recommend merging Reporting Forms 1 and 2. The only significant difference is that hospital staff are implicitly being invited to make up their own case definitions, while everybody else gets the helpful reminders right there on the page. This makes little sense to me, and the efforts to explain it (e.g., "only

physicians are allowed to make diagnoses; others can just list symptoms") do not seem germane to the issue. The goal is to get everyone to use case definitions consistently, and to do that you need to tell people what the definitions are. Form 1 tries to do that; form 2 doesn't. While people may not always follow syndromic case definitions to the letter, one makes it easier for them to at least try by including the definitions on the form.

Form 1 asks for the population size of "Evacuation Centers" only, but I thought that all health facilities had to include population size figures or their messages would be rejected? Either that is incorrectly worded on the form (i.e., don't specify Evacuation Centers) or I missed something (which is quite possible). Moreover, most sites seem to prefer reporting "0 0" populations, perhaps because fixed sites may already have a roughly constant population and they tire of sending the same numbers every day? Maybe this really does only apply to temporary sites? If non-evacuation centers are being asked to report "POP 0 0" as a default, it would seem better to program that requirement out of existence; there is no obvious good reason to require dummy language in an SMS report.

I would revise the paper reporting form(s) to take better advantage of the available space and give it a more polished appearance with more room to write legibly. It is not necessarily a big thing but it does make the task look a bit less daunting. There is no reason to number the rows; that column could be replaced by the disease codes rather leaving them embedded in the text. All forms should include a footer showing the production date; this is the best way to ensure that people are using current versions. For an example of what a streamlined layout might look like, see Appendix 2.

Consider adding several "generic" questions to the daily report to stimulate thinking about problems of public health importance that may not be readily apparent from case numbers alone. For example,

- Any unusual number of cases or deaths this week?
- Any unusual illnesses noted this week?
- Any reports or rumors of unusual diseases or possible outbreaks in your area?

If yes, reporters should elaborate in free form messages.

Disease Codes. It's another minor point, but if I were doing it again, to minimize the consequences of typing errors, I would recommend disease codes that differ by at least 2 loci. There are several pairs that are unnecessarily easy to mis-enter (ABD/AWD, MEN/MEA). With 3 letters there are >17,000 possibilities to choose from.

Alert Messages. As already mentioned, it is still not clear to the reviewer why anyone would need to send a relatively cryptic alert-specific message (e.g., "HF X ALERT ABD 22 0 4 0," for example) when those same case counts would also be in the regular daily report and would automatically trigger an alert. If one needs to send an urgent message by SMS that can't wait until the end of the day, wouldn't it be better to send something more meaningful?—e.g., "HF X ALERT Seeing 26 people with ABD this morning, mostly kids, but a few adults. Some vomiting and severe cramps. Please call to discuss" Obviously if communications allows one could just pick up the phone. There is value to sending a formal alert message through channels to get it

on the official record, as this may help ensure adequate followup and reduce the likelihood of problems being overlooked, but all that said, the system could be easily tweaked to allow messages in a more flexible format, e.g., “HF X ALERT FREE TEXT HERE.”

I am confident that this would discussed when SPEED reporting was designed, but I would vote would those who wanted to have zero reporting from sites. There are so many reasons why sites may drop out of the reporting, and only a zero report (e.g., something like “HF HFCODE MM/DD/YY ZERO”) provides any reassurance that a site is still alive and kicking. It shouldn’t take but a minute if mobiles are active.

As mentioned earlier, the alert threshold algorithms should be periodically reassessed. Unless I have misunderstood how it works, automatic alerts are triggered only from individual health facility reports. Aggregated report tallies from multiple locations do not themselves trigger automatic alerts to higher level offices. While there are problems that can arise from over-aggregation, larger scale triggers deserve thought.

SMS Interface. First off, it must be stated that this SMS system is really a thing of beauty: very clever, efficient, and easily implemented with existing technology.

A commonly reported and unambiguous error is the substitution of a letter “O” for a zero “0” in the case counts. These can and should be automatically corrected by the software; there is no reason to waste people’s time and load by forcing them to resend. If there are other errors that are similarly unambiguous they should likewise be automatically corrected (see examples on pp. 42–43 of SPEED Operations Manual). Errors that cannot be resolved should be queried.

At present confirmations are sent for well-formed messages, but apparently not for ones with obvious errors. It seems like it would be worth also sending helpful error messages (e.g., “Facility code is incorrect”; “case counts are missing spaces and cannot be read”). This would increase traffic a bit but one would think only marginally (aren’t most messages correctly formed?), and would seem to be more helpful to the sender than just the absence of confirmation.

Database. At present it is only possible to tell if a health facility is currently enabled or disabled; there is no way to tell its status at an earlier date. Adding another table with dates for status changes linked to the facility would fix this and make it easier to calculate denominators over time.

It is also not clear that one can tell which reporting sites have been activated, or have been told that they should be activated. One can obviously tell which health facilities are reporting, but that is not the same thing. For example, if all hospitals and barangay health stations in an area are asked to report, is the denominator of supposedly “on” facilities readily available to the database? I have the impression that it is not, as this would require tracking the on and off activation dates for each facility. This seems doable and desirable, but I don’t think it is being done, which again makes it difficult to assess participation rates.

Training. Training is essential to the proper use of any system, and there has been a great deal of SPEED training conducted at least at Regional, Provincial, and Municipal levels. Training for barangay health workers and other front-line staff has been less complete. Training is one of the most expensive components of SPEED,

and it will be an ongoing expense, particularly if (as designed) real-life opportunities for practice are intermittent and, for most users, infrequent.

It is worth considering the apparent success of conducting emergency trainings in Cagayan de Oro and Iligan City *after* the disaster occurred. Even under those difficult circumstances, and with no prior exposure to SPEED, reporting was fully operational within less a week following the disasters. This is not only a tribute to the simplicity and acceptability of the system, and the skill of the trainers, but it also illustrates that lowest level routine trainings, while desirable, may not be essential to the operational success of SPEED. If there are budgetary constraints, one could consider focusing training only on MHO and higher levels, with the emphasis on teaching how to rapidly train barangay health workers, hospital staff, and others in emergency situations. If needed, national or regional HEMS trainers could be deployed to help train front line staff after the emergency happens. Of course, some general orientation to the system would help prime these workers for a quick and effective training.

At the national or regional levels, SPEED staff should maintain a database detailing training histories. A standardized SPEED Training Report Form (collecting information about date and location of training, number and description of trainees, etc.) should be developed to ensure that appropriate data are collected and submitted. Appropriate incentives should be considered.

Training Materials. To maximize their utility, training materials should emphasize that the system may evolve and current materials may not be exactly the same as the samples shown. In describing the system, try to be as “generic” as possible. For example, instead of specifying that there are precisely 21 conditions to report, say that there are “around 20” or something like that. Emphasize that forms and other materials may evolve over time so that users will not be surprised by minor changes.

If not already available, develop short (2-pager?) training materials that can be used to quickly orient NGOs and internationals on how to report through SPEED. These materials may need to be more self-contained than the regular materials.

The experience with the National Simulation Exercise (Simex) in July 2012 would suggest that future exercises might be better run in bite-sized chunks, perhaps only one or two Regions at a time. This would offer many obvious advantages, including allowing more attention to the quality of data analysis and response.

Web site. The web site is an important marketing tool as well as a gateway to your electronic file cabinet of supplies, but I found the current site limited in scope. Internet resources will become increasingly important as more offices and primary care providers become connected. I would suggest reorganizing the site to make it a better resource for all users, with links to all available documentation, including forms, case definitions, user manuals, training videos, etc., as well as data entry and analysis portals. Links to SPEED In Action newsletters, stories about SPEED in the news media, etc., and links to PIDSR would also be worthwhile. Only the data entry and analysis areas needs to be password protected. If available, try to get a simpler URL (e.g., speed.ph, speedsurv.ph, doh.speed.ph) and then put this URL on all your future forms and other materials. Make it the “go-to” place for help on SPEED.

It is a common error for users to enter test or practice data on the “real” site (*speedsurveillance.org*) rather than the test site (*demo.speedsurveillance.org*). It would be better to have a single point of data entry on line that then require users to select “practice” or “real”—something like that—to force them to the proper location. For SMS users, there are two phone numbers: one for tests, and one for real reports, so changing the web page wouldn’t help them much. I’m not sure how to fix this problem, but I would give it more thought. You need some mechanism to clear that junk out immediately. Since anyone can dial in and start reporting, it would be good to somehow flag reports that are coming in from areas where SPEED is not officially activated. These reports may represent (over?) enthusiastic participants at primary levels, practice data, or something else that needs attention (or not, as the case may be). I would also recommend adding features so that one can more readily see where sites are enabled and when: tables, color-coded maps, etc. This data table should include dates of activation and deactivation so that one could look back and tell the status of all reporting areas on any given date.

A more standardized way of naming disasters would be helpful. At present it would appear that any user can enter a new name in any format that they like. Thus today (August 8) we see “flooding, Typhoon Gener, typoon genre” and possibly other things (Typhoon Z??) all referring to the same incident. It is OK to allow LGUs to enter a provisional name, but at some point (soon) after activation someone at HEMS nationally needs to merge these into one category with an informative and standardized name (e.g., Typhoon Gener, or “flooding associated with Typhoon Gener”, or whatever it may be). It must be acknowledged that there may be overlapping disasters in the same area at the same time; this needs to be thought through by people with experience. Every original report is associated with one health facility and one date, but not necessarily with only one disaster (indeed, in some outbreaks perhaps not even any disaster *per se*). That said, there could be a separate table within the database (or more prominently displayed if it already exists) of the list of “disasters” with dates and a thumbnail sketch of the event (e.g., volcano eruption, widespread flooding following heavy rains from monsoon and not-so-nearby typhoon).

There is an apparent lack of security to the raw data entry site and possibly its underlying database that makes me a little nervous. It would appear that anyone with a password (even this reviewer) can not only see but alter any data for their jurisdiction or any levels below them. I would be concerned less about malicious damage than about inadvertent changes. We could not tell what kind of tracking and rollback capacity exists. If is not already done, consider locking records of a certain type or age, and somehow preventing users from modifying records with adequate safeguards and confirmations. Backups are presumably being regularly exported; who knows how to restore them?

Some of the data tables would be easier to read were the disease codes (ARI, ABD, etc.) in their own column rather than embedded in the text (same recommendation as for paper form; see Appendix).

If it does not already exist, it would be worthwhile to develop a mapping feature that could display a spot map of health facilities filing SPEED reports on any given day (week, etc). Even better would be the ability to display all registered health facilities

in affected areas and then to show (e.g., by color code) which ones are reporting and which ones are not. Again, without zero reporting it is difficult to readily evaluate participation levels.

Marketing. No real recommendations here to improve (beyond the web site), but it is important to continue the existing effort to market SPEED both to public health audiences and externally. With WHO funding ending and the WR scheduled to leave in November 2012, it is time for DOH to assume this responsibility. There would be interest internationally in SPEED, and WHO should encourage key DOH personnel to participate in appropriate forums.

Alert Registry. A concerted effort should be made to track alerts and the responses thereto. We could not find any comprehensive listing that would allow one to see how many alerts were generated, how many were responded to, what the response was, how many were false alarms/not worth any significant response/otherwise not verified/etc. This kind of data is essential to calibrating the thresholds for action or for calculating the positive predictive value of an alert. The costs of response must be factored in too; if it just takes a quick phone call to clarify or rule out the need to pursue an alert, there is little incentive to raise the alert threshold. If it is an expensive project to followup because of transportation, laboratory testing, etc., then the opposite would be true. Note added: At the HEMS Operations Center on August 8, I was shown what may be the kind of registry I was looking for with at least some notes about who was supposed to be responding and what they said they were going to do. So it may be that this does exist and I just didn't see it. If so, it may not be organized in such a way as to make analysis easy to do. Regardless, it would be useful to have such a report characterizing something like a disaster's worth or a year's worth of alerts: what happened with them.

SPEED and PIDSR integration. If they are not already, NEC epidemiologists and their counterparts at Regional and Provincial levels (RESU/PESU/MESU's) should be fully cross-trained in the use of SPEED data, and should institutionalize their access to SPEED data, adding it to their other sources of surveillance data. Imperfect as they may be, they are clearly (with 2 or 3 exceptions) communicable disease surveillance data, and one should be able to readily consider them despite their limitations. I would think that it would be of great interest to explicitly compare the relative utility of data from SPEED and PIDSR in situations of overlapping coverage. This is not meant to be a "battle of the bands"—the systems should be complimentary, not competitive. That said, both systems may have something to learn from the other, and users should be open to modifications to either system that will increase usability and utility.

For example, the current cholera outbreak in Bicol, including but not limited to Catanduanes, would seem to provide an ideal opportunity to run both systems concurrently, allowing them to be compared and contrasted. Do diarrheal disease indicators track together? If not, why not? Is it a lack of specificity in SPEED, a lack of sensitivity in PIDSR, or is there another reason? SPEED is not designed to provide a lot of the detail that would be necessary to any complex outbreak response, and it must be supplemented with more in depth investigation. Even the current flooding that is occurring as this report is being written (August 2012) is an opportunity to compare data from SPEED and PIDSR. The lessons learned from

studying several such incidents would undoubtedly help NEC epidemiologists develop a better appreciation (good or bad) for the utility of SPEED data. If may lead to more interest in rapid surveillance reporting in non-disaster settings, which then could be pursued on its own merits. It may lead to suggestions for modifications to SPEED case definitions or disease categories that would make the two systems more explicitly complimentary.

External Comparisons and Portability

WHO has introduced post-disaster disease surveillance systems in several locations, including post-tsunami Indonesia (Aceh), post-earthquake (and later post-flood) Pakistan, and conflict-affected Sudan.[5] A Technical Workshop held in Geneva in December 2009[6] reviewed the history of such systems and general "lessons learned." A follow-up document came out in 2011[7] and guidelines were published in 2012.[8]

In other settings, the systems have typically been weekly, paper-based reporting of case counts for 12–20 syndromes with case definitions similar to those used in SPEED. Reports are keypunched when they reach levels with reasonably consistent computer and internet access (often WHO-staffed nodes). Aggregated data are only readily available at the highest levels, and not always in a user-friendly format.

While these surveillance systems have some utility, as "systems" they have been disappointing. Data quality is typically poor, and integration with national surveillance systems has been uneven (and sometimes nil). NGO reporting is often more consistent than reporting by government facilities, which is often poor. Typically, EWARN systems are run directly by WHO with WHO-paid surveillance officers, including local and international staff; the national ministry and more local public health officials are aware of but sometimes not very involved with operations. The ability to respond is sometimes good in these situations because of the presence of so many emergency workers (again, many of them internationals), but the response is ad hoc and sometimes poorly integrated into a broader public health system. Most reviewers have concluded that the most value has come from the *ad hoc* alert side of the system (e.g., people informally reporting possible outbreaks), and relatively little from review of aggregated case count or death data.

The SPEED system provides a marked contrast to those other systems. It does not attempt to do everything, but as a limited scope emergency management tool it does appear to accomplish what it intends to do. Most importantly, SPEED has been integrated into a relatively sophisticated and domestically-managed program for disaster preparedness that is run by government professionals, not by WHO or outside agencies.

Prerequisites to success

Is SPEED a model program that other countries could copy? It is designed to fill a need that is almost universal. SMS-based reporting in particular is a tool that could

[5] These locations were among the first wide scale deployments of "EWARN" (Early Warning and Response Network) systems
[6] http://whqlibdoc.who.int/hq/2010/WHO_HSE_GAR_DCE_2010.4_eng.pdf
[7] http://whqlibdoc.who.int/hq/2011/WHO_HSE_GAR_DCE_2011.2_eng.pdf
[8] http://whqlibdoc.who.int/hq/2012/WHO_HSE_GAR_DCE_2012_1_eng.pdf

have wide applicability for surveillance in both post-disaster environments and in other countries with poor computer and internet access. That methodology should be separated from the other aspects of SPEED that may not be appropriate or necessary in other areas (e.g., daily reporting rather than weekly).

The Philippine system works because several necessary antecedents are in place. In countries without these antecedents, a similar system might flounder.

First, there exists a public health infrastructure with many highly trained and dedicated professional staff—staff who understand the value and utility of both emergency management and disease surveillance. There is a trained cadre of emergency management professionals as well as epidemiologists. The Philippines has had an FETP for over 25 years, and graduates of the program are now salted throughout the public health system. Regular trainings have provided basic epidemiology skills to even nurses and midwives at the barangay level. Thus, disease surveillance *per se* is already understood and appreciated as a pillar of public health practice, so SPEED is seen as part of the broader surveillance effort; it is not a foreign concept. Managers and political leaders are learning to appreciate the need for (relatively) hard data, and expect the public health system to be able to provide it, even (and perhaps especially) in disaster situations.

Second, that public health infrastructure means that there is a network of trained people to respond to these surveillance data. We did not assess the consistency and quality of that response, but the short history of SPEED in action (e.g., widespread distribution of prophylaxis for leptospirosis in Cagayan de Oro following initial scattered reports) suggests that it can be used effectively.

Third, the communications and transportation infrastructure in the Philippines is sufficiently developed to ensure reasonably reliable communication in almost all areas within a few days of most foreseeable disasters. SPEED is designed with redundant avenues for data submission, and while SMS reporting is one of its hallmarks, other options from internet to phone, fax, and paper are equally valid. Timely surveillance depends on communication, and inexpensive communication of this kind depends on technology.

Fourth, while WHO's role as midwife and nurse to this project must be acknowledged, from the earliest stages this was a domestic project steered by the DOH and with ample input from public health workers at all levels. The willingness and even insistence upon incorporating suggestions and criticisms during development has ensured that "ownership" of the project is very broad, and we see this reflected in the rapid acceptance of the system.

In summary, the ongoing Philippine experience with SPEED is very relevant to other countries and international agencies. While such a comprehensive effort would probably not be successful in countries with relatively low human and capital resources, there are many countries where it could be a viable model. Even in low-resource countries, the technique of SMS-based health reporting deserves consideration.

Conclusions

Overall, the SPEED program is a remarkable accomplishment. Within the space of only 2 years, a simple, inexpensive, and yet sophisticated surveillance tool has been developed, tested, refined, and deployed nationwide.

It is important to bear in mind that SPEED is not an SMS delivery system. It is a public health surveillance system, the point of which is to collect, analyze, and disseminate information for action. SMS is only a means—one of several means—to the end of collecting those data in an environment without reliable computer and internet access, and without the luxury of individual case record data. Over the past two years, the focus in SPEED has largely been on building the infrastructure for the system and training people in the mechanics of reporting. While there will be a never-ending need for that kind of development or system maintenance and for training, it is time to step up efforts to enhance the ability of public health leaders and other decision makers to make meaningful use of these data. The syndromic nature of the data is adequate for a quick, high-level, look at public health issues, but an adequate public health response to many alerts is still labor-intensive, demanding careful analysis and proper interpretation of SPEED data. Some component of laboratory testing will also be necessary for maximum effect. A comprehensive response will require continued cooperation and coordination between emergency management, epidemiology, environmental health, laboratory, and other public health programs. If there is sufficient interest in exploring the utility of daily reporting using a SPEED-like reporting system in situations other than post-disaster emergency management, there are opportunities available now to explore those possibilities and identify the constraints.

ACKNOWLEDGEMENTS

In addition to Drs Aura Corpuz and Peter Mala, I would like to thank the rest of the SPEED and surveillance staff at the WHO-Philippines office—in particular Dr Ian Gomez, Dr Gerrie Medina, Ms Julie Villadolid, and Ms Christine Ringor—and the WR for the Philippines Dr Soe Nyunt-U. All of the staff were most welcoming and helpful and I much appreciated the interactions both personal and professional.

APPENDIX 1. INTERVIEWS

Date	*Location*	*Interviewee(s)*
16.7.12	WHO country office	Dr Soe Nyunt-U, WR-Philippines
18.7.12	Region IV-A CHD	Dr Gonzaga, RD; Dr Pasion, Bles
18.7.12	Rizal Province	Henry PESU, Claire, Dr Victoria
18.7.12	Binangonan	Dr De la Cuesta, MHO; Mayor Bonet Ynares
18.7.12	Talim Island	RHU Gulod Malaya, nurses and midwives
19.7.12	CDO, Region X	José Llacuna MD, ARD
19.7.12	Cagayan de Oro	City Administrator Leon Gan Jr.
19.7.12	CDO, MHO	"Joey" Retuya MD, City Epidemiologist
19.7.12	CDO, Region X	David Mendoza MD Regional Epi and Regional HEMS coordinator; Jasper
20.7.12	Iligan City Health O.	Livey Villarin MD, Charlene Cañaveral, Eddie Morales, Gem Columba
20.7.12	Iligan City, Councilor	Chonillo Ruiz MD
20.7.12	St Xavier H, CDO	Sheila Yap, surveillance officer; Sister XXX, Administrator
23.7.12	Bulacan Provincial H.O.	Gloria Ylan, May, Irish San Pedro
23.7.12	Bulacan Prov. Hospital	Protacio Bajao MD, Admin; Corazon Cruz RN
23.7.12	Bulacan Province	Jim Valerio, Provincial Adminstrator
23.7.12	Tarlac Provincial H.O.	Cecille Lopez-Zuasula, PESU; B.J., Dr Lazartin
24.7.12	RHU La Paz, Tarlac City	Segundino Allarde MD
24.7.12	Tarlac Province	Victor Yap, Governor
25.7.12	HEMS, DOH	Carmencita Banatin MD, HEMS Director
26.7.12	DOH	ASEC Eric Tayag MD
26.7.12	DOH NEC	Edna Lopez, Vito "JoJo" Roque Jr MD, Epidemiologist
26.7.12	RITM	"Coco" Joselita Lupisan MD, Asst Dir; Lidia Sombrero
27.7.12	IT consultant	Ayedee Domingo MD
27.7.12	DOH IMS	Emily Razal
31.7.12	Malakina city health office, NCR	Mr Edni, HEMS coordinator (phone interview)
2.8.12	Pasig City, NCR	Dr Poblete, HEMS coordinator (phone interview)
9.8.12	AusAID, Makati	Anne Orquiza, Erika Montero-Geronimo, Katie Whitting, Roland (?)

I regret that a more complete roster and the correct spelling of everyone's names is not available. There were addtional interviews with Marlene and other staff in the HEMS office at DOH on multiple occasions, as well as with WHO staff in the country office.