Original research

An evaluation of the surveillance system for dengue virus infections in Maldives

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ABSTRACT

Background: Dengue is endemic in Maldives. The largest epidemic to date was in 2011. This study evaluates the surveillance system for dengue during 2011, identifies gaps and suggests ways to improve.

Methods: This evaluation of the national surveillance system for dengue was done in September to October 2012, using an evaluation tool based on United States Centers for Disease Control and Prevention (US CDC) guidelines. Staff involved in surveillance of different levels, and doctors expected to notify, were interviewed, and surveillance data from the Health Protection Agency (HPA) were compared by use of an independent database of the country's national referral hospital in Malé, Indira Gandhi Memorial Hospital (IGMH), to assess sensitivity and timeliness.

Results: National surveillance is conducted by HPA, which collects information daily from a network of health facilities. Standard case definitions were published, but they were not easily accessible to clinicians. The quality of data was acceptable. Information is disseminated as annual communicable disease reports to health facilities and uploaded onto the official website. The timeliness of reporting was good (median 2 days). However, the usefulness for early warning of outbreaks was limited, owing to central and peripheral resource limitations. Data were useful for planning. Sensitivity was 0.54. Acceptability by clinicians was poor, owing to the lack of feedback reaching them. The reporting rate was high from the paediatric ward in IGMH (85%), where the responsibility of notifying was also assigned to ward in-charge and support staff, but it was extremely low from the medical ward (1.7%), where only doctors were given the responsibility.

Conclusion: This evaluation shows the performance of the dengue surveillance system was good overall. However, clinicians need more regular feedback. The performance could be improved significantly by written protocols, legislature and assigning the responsibility of surveillance in hospitals to ward managers in addition to doctors.

Key words: dengue, dengue haemorrhagic fever, doctors' role, dengue shock syndrome, evaluation, surveillance, Maldives

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INTRODUCTION

Dengue is a mosquito-borne disease with significant morbidity and mortality. Over 40% of the world's population is currently at risk from dengue. The World Health Organization (WHO) currently estimates that there may be 50–100 million dengue infections worldwide annually. Dengue is found in tropical and subtropical countries worldwide, mostly in urban and semi-urban areas. Severe dengue is a leading cause of serious illness and death among children in some Asian countries. There is no specific treatment to cure dengue, but with early detection and good clinical management, the case-fatality rate can be reduced to less than 1%. Vector control, environmental management and community mobilization are important for effective prevention and control. Surveillance is crucial for early detection of outbreaks and timely control.[1]

Maldives is a small country, with a population of about 330 000 dispersed over 194 inhabited islands.[2,3] The central public health authority – the Health Protection Agency (HPA) is responsible for surveillance as well as public health services, interventions and planning for disease control and health promotion. Surveillance is conducted by the Communicable Disease Surveillance Unit of the Communicable Disease Division.

Dengue was first reported in Maldives in 1979, as the first dengue outbreak. Thereafter, outbreaks were reported intermittently. Dengue is now an endemic disease in Maldives, with perennial occurrence and seasonal peaks during the months of June to August each year. It was the fourth most commonly notified disease in 2011. After a major outbreak in 1998 and 1999, surveillance for dengue began in the year 2000. Case-based data were collected and are available from 2005.[4–6]

The objectives of the dengue surveillance are to characterize seasonal patterns of dengue infections, to detect epidemics and take control measures, and to plan and prioritize efforts to control the disease in Maldives. The last epidemic in June 2011 was the worst experienced, with 2909 cases and 12 deaths. However, the case-fatality rate was maintained low at 0.4%, with good clinical management nationwide.[5,6] There was some criticism regarding the inadequacy of public health measures related to this outbreak. The surveillance system of Maldives had not been formally evaluated in the recent past.

This study was conducted to evaluate the surveillance system during the year of the epidemic, identify gaps in the surveillance system, and suggest ways to improve the functioning of the system.

METHODS

A qualitative evaluation of the national-level indicator-based surveillance system for dengue infections was conducted in September to October 2012, using an evaluation tool based on the United States Centers for Disease Control and Prevention (US CDC) *Updated guidelines for evaluating public health surveillance systems*.[7] This study reports on the following attributes:

- data quality – assessed by the completeness of core data fields and proportion of duplicates and proportion of confirmed cases, i.e. positive predictive value calculated using the proportion of patients diagnosed with dengue fever (DF), dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS), with clinical or laboratory confirmation;
- simplicity – assessed by method of notification;
- sensitivity – the proportion of individuals given the final diagnosis of DF, DHF or DSS from the national-level referral hospital Indira Gandhi Memorial Hospital (IGMH) that were detected by the surveillance system;
- acceptability – assessed by the reporting rate and views of doctors;
- timeliness – assessed by the time taken from the date of onset to date of notification; the ideal assessment by time from the date of consultation to the date of inclusion in the database could not be done because the date of receipt of notification to HPA and date of entry into the database were not recorded.

A semi-structured questionnaire consisting of 16 main questions was used. Staff involved in surveillance at different levels of the surveillance system were interviewed. This included a policy-level person, a staff member of the Communicable Disease Surveillance Unit, a staff member of the Medical Records Unit of IGMH, and a laboratory staff member of IGMH. To assess sensitivity and timeliness, data on dengue patients reported to HPA from IGMH were accessed with the necessary permissions and compared with data in an independent patient database maintained by the Medical Records Unit of IGMH for the hospital's use. Data for a one-month period in May in 2011 were selected for comparison because, as this was the month before the epidemic was declared, there were more cases, while it was hoped to reduce bias from increased reporting after official declaration and media publicity. Daily inpatient lists compiled by nurses were compared with the list of reported cases prepared by the hospital Medical Statistics Unit. Doctors in hospitals in Malé and Hulhumalé were interviewed using a separate questionnaire to assess the acceptability of the system and identify how data are collected at the hospital level (see Supplementary Online Annex 3 for questionnaire).

RESULTS

The national surveillance system for dengue covered a population of approximately 317 000, scattered over approximately 200 inhabited islands as estimated for 2011. Approximately one third of the population lives in the capital Malé. There are 21 administrative divisions (20 administrative atolls and Malé city).[2] HPA collects information from a network of atoll hospitals and from the tertiary hospital and other hospitals and clinics in Malé. The flow of data is shown in Figure 1.

Standard case definitions were used and a case definition booklet was published in 2008 and disseminated,[8] but case definitions were not easily accessible by the users (reporting clinicians) at the time of the evaluation. Objectives were defined for the communicable disease surveillance system, but surveillance staff were not aware of any written documentation of the objectives.

The surveillance system for dengue is mainly indicator based. Aggregate data in the form of daily counts and individual case-based information are collected. Information is collected on a daily basis from all health facilities, using a real-time online software database (SIDAS), fax and email (see Table 1).

Who notifies?

Although there are no written procedures or legislation indicating who is responsible for notifying, it is expected that the forms will be completed by treating clinicians. Usually

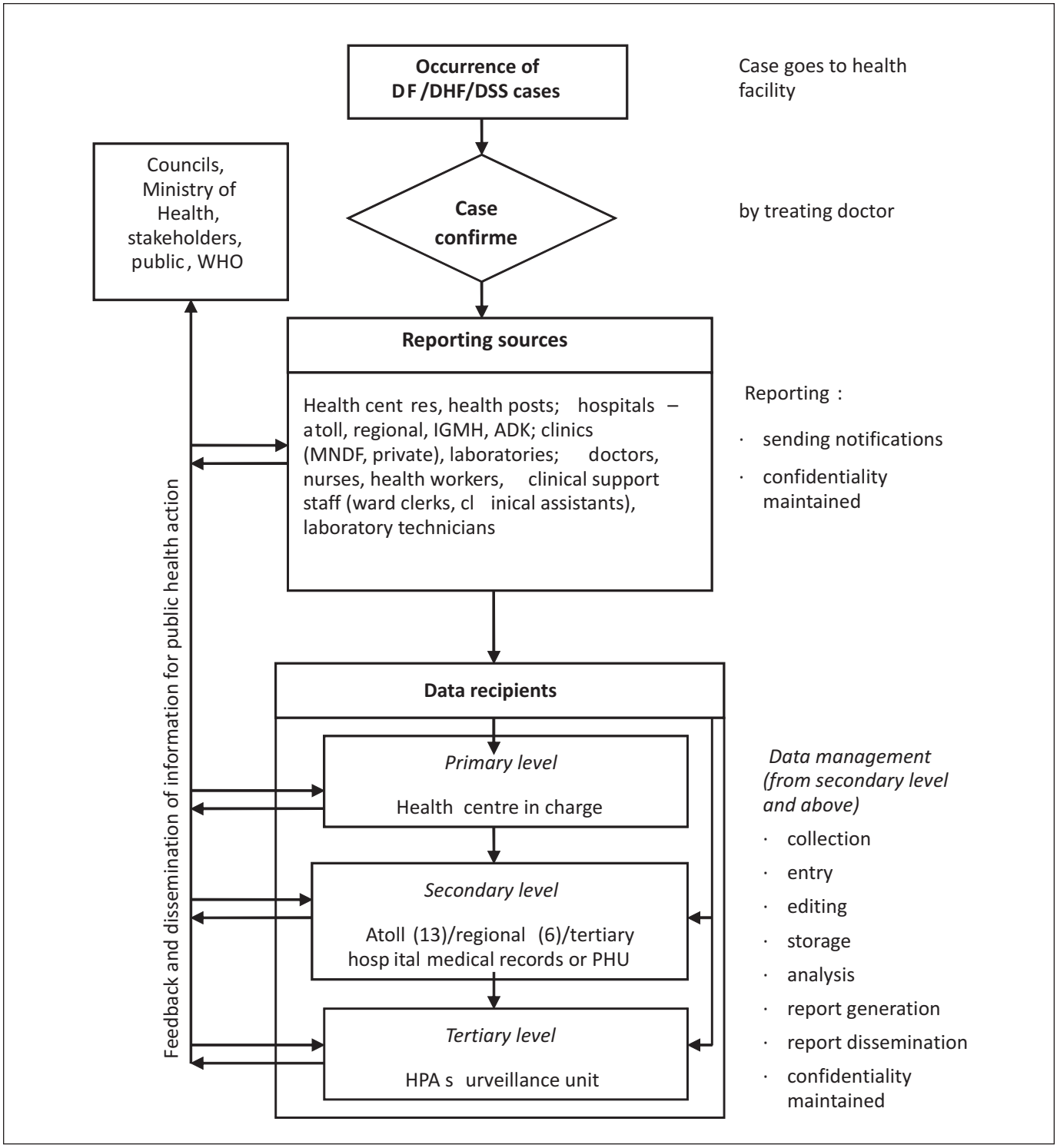

Figure 1: Data flow through the national surveillance system of Maldives

ADK : ; DF: dengue fever; DHF: dengue haemorrhagic fever; DSS: dengue shock syndrome; HPA: Health Protection Agency; IGMH: Indira Gandhi Memorial Hospital; MNDF: Maldives National Defense Force; PHU: Public Health Unit; WHO: World Health Organization.

Table 1: Methods of receiving notifications during the month of May 2011

Method	Number (%) in May 2011	Remarks
Web – entered directly or onto Excel sheets uploaded	95 (36.7)	From atoll and regional hospitals
Email	142 (54.8)	From IGMH
Fax	22 (8.5)	Hulhumalé, Villingili private hospitals (ADK) and clinics Other centres sometimes fax data when they have disruption of internet connection or software malfunction. Owing to internet problems, all reports from K Atoll1 (Thulhusdhoo is the administrative centre) are generally faxed, despite having access to the SIDAS system
Telephone	None in May	Deaths were informed by telephone as well – one in February, two in June.
Post	None (not used)	—
Total	259 (100%)	

[1] K Atoll is where the capital Malé is situated. However, for administrative purposes, the islands of Malé, Hulhumalé and Villingili are under Malé city and suburbs, while the island of Thulhusdhoo is the administrative centre for the rest of the atoll.

these are doctors, except in islands where primary health-care workers are the only clinicians. In many peripheral hospitals, clinical assistants or ward clerks complete forms, and doctors sign them. In the wards of IGMH, forms are completed by doctors. In the paediatric ward, in-charge nurses and ward clerks are also given the responsibility of ensuring notification, and assist in completing forms. In the medical ward of IGMH, the entire responsibility of notification is left to doctors. At the time of the evaluation, all hospitals, health centres and clinics (government owned and private) had been instructed to report cases of dengue infections. The central-level policy is that responsibility has been given to institutional, rather than individual health-care providers. However, at the reporting level, clinicians and hospital staff were of the opinion that that it is the responsibility of doctors.

What information is collected?

Case-based information was collected, relevant to person, place and time, case classification, diagnosis (DF, DHF and DSS), and laboratory confirmation. There were some gaps in the notification forms, which did not cover outcome (death or discharged) clearly, and indicator of disease burden (whether outpatient or admitted). However, the practice of informing all deaths from dengue by telephone to the surveillance unit was maintained. The field for address was also not worded to capture the address of residence, which is important for control measures. Box 1 details the information collected by the notification form. The notification forms had slight variations from one hospital to another, despite a template being provided in the case definition booklet,[8] as hospitals printed their own forms.

Receiving and storing data

An online electronic system, the WHO South-East Asia Regional Office Integrated Data Analysis System (SIDAS), is used though the surveillance network. Data can be entered offline and uploaded, and thus can be used at peripheral locations. Trained medical records officers or community health workers enter data into SIDAS from atoll hospital level, where internet facilities are available. A SIDAS user manual is available at all atoll hospital surveillance units, and centrally for reference.[9]

Security of the system, and patient confidentiality, are protected by password-protected access to the SIDAS system. The data-entry officers at the statistics units in atoll and regional hospitals, and surveillance officers at HPA, who enter and edit data, are provided a username and password by HPA. However, the system is not sensitive to IP address, and can be accessed from any computer by a person with an authorized username and password. This allows it to be used by individual health-care providers to report data online. However, this facility is not used, as it may threaten data quality and confidentiality, because of the lack of restrictions to edit and access individual patient data on the system. Therefore use of SIDAS is restricted to atoll-level and central-level data entry by HPA. The same username and password give access to entering new data as well as accessing and editing individual patient information. The present system saves each patient's name, age, sex and address, but no telephone contact number. As there is no stigma associated with dengue infection, patient confidentiality may not be a major problem at present. However, the easy availability of identifiable names and addresses with little restriction could threaten individual confidentiality.

This system is used for all notifiable infectious diseases, including tuberculosis, but excluding HIV and sexually transmitted infections, as they require a higher degree of confidentiality of patient information.

Data management and analysis

Data can be edited at atoll level and at central level by HPA. The approved users can also edit patient information online or locally and upload into the system, and, conversely, download

Box 1:
Information collected in the communicable disease notification form

- Name of patient, age and sex, (hospital registration number – added by hospitals)
- Address, separate fields for:
  - atoll
  - island
- and two addresses:
  - permanent address
  - temporary address (in the island where the patient is hospitalized). This is printed as "Address in Malé" in reporting forms of IGMH.

(The instructions in the form do not specify to record the address where the patient lived at the time of contracting the disease.)

- Date of onset of illness (not printed in IGMH form)
- Date of admission (for admitted patients)
- Date of consulting the doctor (for outpatients)
- Names of the doctor who diagnosed, the doctor who referred, and, finally, the doctor or person reporting (3 separate fields)
- Diagnosis – 2 fields:
  - preliminary or clinical diagnosis
  - confirmed diagnosis supported by laboratory tests
- Case classification: suspected/probable/confirmed (not printed in IGMH form)
- Condition of the patient
- Comments
- Reporting person's name and signature and date. (Forms in IGMH and Hulhumale hospital specify this field as "reporting doctor".
- The fax number of CCHDC is given at the bottom of the form for faxing reports. Two names and land phone numbers of contact persons to be called in non-official hours are also given in the form. However, the staff at CCHDC has changed, and this is not updated on the reporting forms.
- The reporting hospital or institution – is not included in the template, but identified by the logo at the top of the form, as individual hospitals prints their own forms.

blank templates and updated Excel spreadsheets to the local computer. Editing is generally done following cross-checking of the address of residence, or when the diagnosis or case classification is revised – following revised reports by notifying health-care providers. Patients initially diagnosed with DF may later be diagnosed as having DHF or DSS. Cross-checks for data quality are only done on address at island level (required for prevention activities), for patients from atolls outside main cities, as the population is too high in Malé and main city islands to trace addresses. Data were analysed manually.

Dissemination

Surveillance information is disseminated as annual communicable disease surveillance reports. The surveillance unit attempts to produce more frequent reports, such as bi-weekly reports, but their ability to keep up with this is highly limited. The reports were uploaded onto the Ministry of Health website, but the majority of doctors interviewed were not aware of this. Atoll-level public health or medical record units analyse and prepare annual reports, which focus more on the regional hospital's own patient data than peripheral data (information from three surveillance unit staff in regional hospitals).

Resources

HPA had two full-time surveillance officers and a programme manager for the unit. They were overworked, and could not keep up with targets. The estimate according to past performance is that about six officers are required for efficient functioning of the unit, including active surveillance for dengue and other priority communicable diseases, analysing regularly for timely detection of outbreaks and appropriate dissemination of data for action. Atoll- and regional-level units have varying staff numbers in hospital medical record units, usually between one and three staff. Public health activities are carried out by primary health-care workers, who have a diploma-level training. The equipment required, such as computers and communication equipment, were available. However, there were limitations in the SIDAS software used, particularly for data analysis, as it could only analyse proportions, it cannot generate graphs or maps, and alert functions cannot be set-up. Also, internet and internal network connections are not stable, particularly in the atolls. The maximum outage was when some atolls were unable to upload data online for a period of about two weeks, owing to a malfunction of the online SIDAS system. In such a case, the atoll stations maintain reporting by faxing information to HPA.

CHARACTERISTICS OF THE SURVEILLANCE SYSTEM EVALUATED

Quality of data

The quality of data was generally acceptable but there were some gaps. There are 11 mandatory core data fields (see Box 1); if these are not complete, the software is designed to not save the case details. However, the core field "date of onset" was incomplete for 69% of entries. These data have been saved, by saving a default system date for the incomplete cases. Therefore, the date of consultation or admission, which was duly completed, was used for analyses.

Core data fields that may be inaccurate include: address of residence, date of onset of illness, and surveillance case classification, as their interpretation was left to the person completing the form. Addresses of residence were verified for cases from atolls, but not for cases from Malé, Addu and Fuvamulah. Fifty-three per cent of patients were notified from Malé. Clinical outcome was not included in the core data field. A data field named "Clinical condition" was used in the system, but doctors were not clear what was required from this field. According to surveillance staff, it was meant to record whether a patient died, recovered or was very sick.

Data are checked for duplicates and cleaned, and laboratory confirmations and outcomes updated by the medical records units of hospitals and the surveillance unit in HPA. There were only 16 repetitions out of 2680 cases entered in the last database by 13 October 2011 (0.06%).

Dengue was diagnosed mainly clinically and the case definition was not strictly followed. Therefore, the positive predictive value was 0.58, calculated using the proportion of patients diagnosed with DF, DHF and DSS with clinical or laboratory confirmation. Laboratory confirmation was not available for the majority (91%) of patients, as dengue serology was often not tested, particularly in Malé. This is because serology is neither a requirement for treating dengue, nor the most useful confirmatory test according to the case definition. The confirmatory tests such as polymerase chain reaction (PCR), virus isolation and quantitative dengue serology tests required by the WHO case definition are not available in Maldives. In order to detect circulating dengue virus (DENV) serotypes during an epidemic, the surveillance unit obtains samples from a cluster of 10–20 patients and tests them from a reference laboratory in another country – the Armed Forces Research Institute of Medical Science (AFRIMS), Thailand. Only DENV-1 virus serotype was detected during the 2011 epidemic, from nine samples obtained. This was not a new serotype to Maldives, and had been detected in previous years as well.

Usefulness

The dengue surveillance data are useful to detect outbreaks of dengue, but the usefulness in early detection was highly limited at the time, owing to the absence of an automated early warning of outbreaks and the difficulty of the surveillance unit checking the dengue data of all atolls on a daily basis.

The data have provided some useful information, including detecting the seasonal pattern of dengue infections, and localizing pockets of outbreak, particularly construction sites in Malé, that require preventive measures. It has helped in quantifying the burden of disease in various areas for planning resources, policy decisions and concentrating efforts in improving clinical treatment. Thus, it seems to meet most of the objectives of the surveillance system, except that of providing early warning of outbreaks. Seroprevalence studies have not been done to date.

Simplicity and flexibility

Dengue surveillance is part of the infectious disease surveillance system. Data flow from the peripheries to HPA is relatively simple using the online SIDAS database. However, it is not so easy to verify data from the reporting person. The island of residence of an identified case could be verified without much difficulty, unless the individual lived in a major city (Addu City, Fuvamulah or Malé). However, as IGMH enters data into a different format and emails them, this added to the workload of both IGMH and the surveillance unit at HPA, as these data accounted for more than half of the notifications.

The doctors interviewed had different experiences. As clinical assistants or ward clerks, who are non-medical support staff, complete the forms for most doctors, these doctors found the process simple, as they only needed to write the diagnosis and sign the form. The two doctors interviewed from the medical unit in IGMH completed forms themselves, and found it a little cumbersome. This sometimes resulted in postponing notification. The forms are in a format that requires most of the requested information to be written; this resulted in variation in information such as diagnoses, which affected the quality of data.

As data analysis is not possible using the SIDAS system, the data files have to be downloaded and analysed separately, using MS Excel, and there is no automatic early warning built in. This presents an additional burden to the surveillance unit. The surveillance system is flexible enough to accommodate changes in case definition. However, adding more data fields, or tiers, and more complex analyses, such as analysis of data by incidence rather than case numbers, and disease burden analyses, are not yet possible.

Sensitivity

Sensitivity was 0.54 for inpatient notifications (n = 154). The breakdown by diagnosis showed that reporting rates were similar for DF (40%) and DHF (38%), while 100% of DSS cases were reported, reflecting the higher tendency to report severe illness. Forty-one outpatient cases of DF and DHF were reported. However, unreported outpatients were not documented, so it was not possible to calculate sensitivity for outpatients.

The system had not been adequately sensitive in detecting outbreaks early, as experienced in the epidemic declared from 1 June, which could have been detected about three weeks earlier (in the week of 8–14 May), and even as early as February for control measures, as seen in the weekly time trend graph (see Figure 2). There is no automatic alert to warn of an outbreak. Surveillance staff had to look at disease patterns manually by creating graphs each time. They were not used to checking on a regular basis until after the epidemic occurred. Since then, dengue data have been updated and checked for outbreaks on a weekly basis. There was no formal event-based surveillance system during this period.

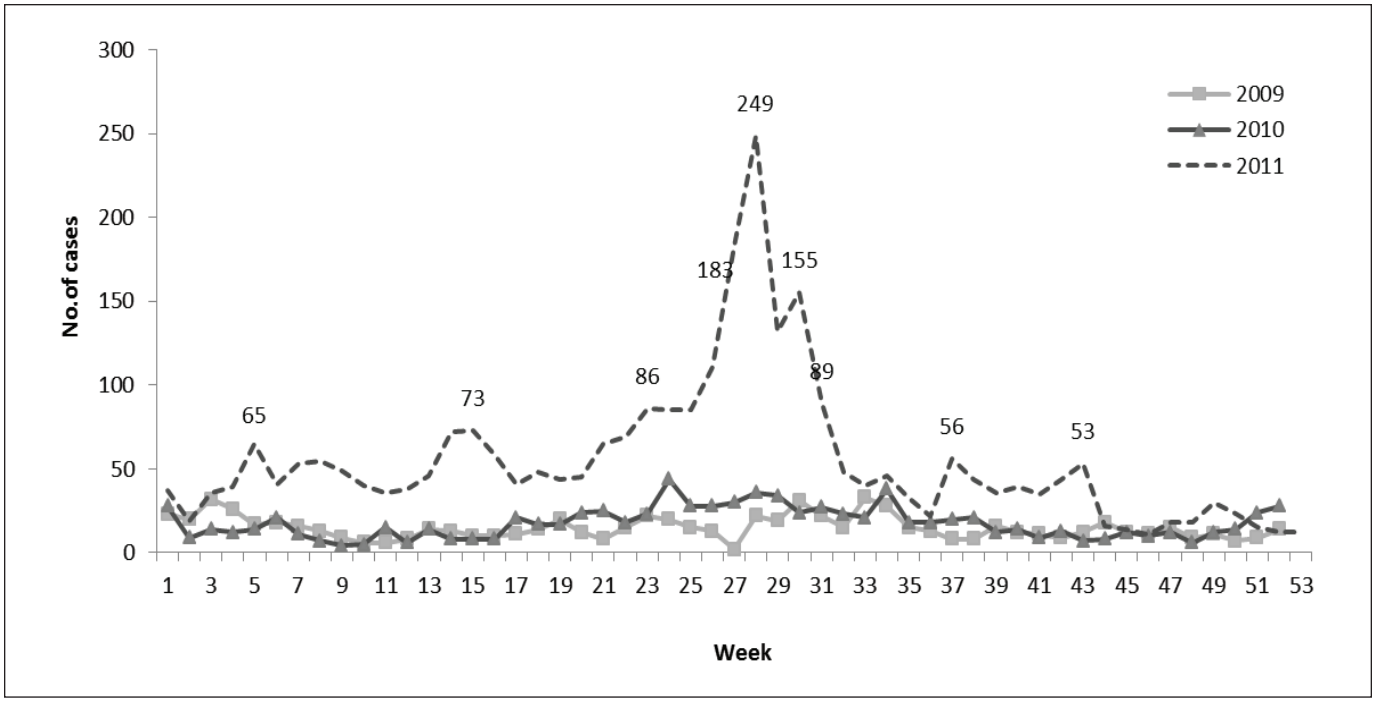

Figure 2: Weekly dengue cases reported from Maldives in 2011, overlaid on trends for 2009 and 2010

Acceptability

A total of 126 centres were required to report dengue infections; 8.9% of health stations did not notify at the time of the study, owing to unavailability of staff. Acceptability to the clinicians reporting was poor. The doctors interviewed were not aware of the usefulness and functionality of the surveillance system. They felt that prevention activities were not carried out with urgency, and were rather delayed at the time of the study. They were not aware of surveillance reports uploaded on the Ministry of Health website.[10] Reporting rates from paediatric versus medical inpatient units showed that 85% of paediatric patients were reported in May, while only one adult patient (1.7%) was reported. The paediatric unit treated almost twice as many patients with dengue infections as the medical unit.

The majority of doctors interviewed claimed that they are too busy and have to prioritize other work, such as patient management, over reporting. Sometimes they forget to report. In all units other than internal medicine, support staff such as clinical assistants or ward clerks help in initiating and completing reporting forms, while doctors only write the diagnosis. This includes the paediatric ward and general outpatient department. Medical officers in the emergency room said that reporting is often not done there, where it is too busy to report outpatients, and it is assumed that inpatients will be reported during their stay. In medical wards, doctors carry out the entire process.

Surveillance staff at IGMH Medical Records Unit claimed that the workload was too much to keep up with. They also claimed that clinicians do not report on time. They found patients admitted with dengue from daily census sheets that were not reported, but were not actively requesting clinicians to report them. Surveillance staff at the central level were also overworked, but very dedicated, and did their best to keep up.

None of the doctors interviewed, whether local areas or from another country, were aware of the epidemiological reports. Most thought that surveillance data were not published. Atoll hospitals, public health units and councils were yet to be added to the mailing list for receiving epi-reports.

Timeliness

It is expected that an outbreak will be investigated within two weeks of first being reported.[11] The average time from onset of illness to reporting during the month of May 2011, before the epidemic was declared, was 3 days (median 2 days). For the month of June, the mean time was 10 days. More recently, in September, after the frenzy of the epidemic had calmed down, the average and median time from onset to reporting was 4 days. This would be acceptable given the natural history. However, it may still not be accurate, as the majority of data for onset of illness were missing (70% for May and 59% for September 2011). The average time between the date of consultation and date of reporting was half a day for May and 2 days for September; 56% and 30% of data were missing for May and September respectively. The most appropriate measure for timeliness (difference between the date of seeking treatment and the date of entering the case in the surveillance

database) could not be calculated, as the date of receipt to HPA and date of entry were not noted. The large proportion of missing data also reduces the representativeness of this calculation. Dissemination of data for action was also very late, with a gap of 5 months for the last report.

DISCUSSION

The quality of data showed significant gaps in date of onset, and addresses showed some inaccuracy. This may have been due to the fact that, at that time, health facilities printed and used their own notification forms. The forms in IGMH did not have "date of onset" printed on them; thus, this field would be unlikely to be completed for over a half of the notifications received from IGMH. The fields for recording address in notification forms was difficult for the reader to understand – there were two addresses – permanent address and "Address in Malé" or "address in island", and these varied across forms in different facilities. Also, as the population of Maldives is highly mobile, and patients are referred from various places, there were confusions in noting address, unless the patient or accompanying person was directly asked for it. Therefore, it was suggested that this field should be revised to "address of present residence", with instructions to ask directly for the address of residence at the time the patient became ill. It was suggested that the field with the confusing term "clinical condition" was replaced by "outcome". The case definitions were not utilized, despite the fact that booklets had been printed. Case definitions should be more widely available to reporting clinicians, by displaying the dengue case definition as posters in wards.

The reporting rate of 54% of inpatients from IGMH was mainly due to the poor reporting from the medical ward. The marked difference between medical and paediatric wards showed that delegating responsibility to nurses and clinical support staff helped to improve the reporting rates greatly, compared to giving the responsibility solely to the doctors. As many doctors claim that they are too busy and have to prioritize other work, such as patient management, over reporting, our opinion is that the institutional responsibility policy helps to maintain some degree of reporting, as other hospital staff are also given the role of initiating the process of notification. We emphasize the need to have good written protocols defining staff and institutional roles and responsibilities that are available and accessible to the surveillance staff and clinical staff expected to notify diseases. This is particularly important because of the high turnover of clinicians in Maldives. After the epidemic, as instructed by HPA, the hospital medical records staff also began the practice of calling wards to retrieve dengue notifications that doctors had missed the previous days.

The unusual timeliness with a median time of only 2 days in May may reflect some inaccuracy of recording the date of onset, as dengue would generally be diagnosed about 3–5 days from the onset of fever.[11] The high variation with a delay of 10 days may be a bias induced by the increased workload during the peak of the epidemic, as the time reduced during the later months.

The delay in detection and declaration of the outbreak suggests the advisability of setting alert levels and incorporating an automated alert in the system. If this is not possible, staff should continue to check dengue trends at least on a weekly basis. Since the epidemic, central-level staff now continue to check on dengue trends on a weekly basis.

The dissemination of reports needs to be improved, in order to gain acceptability and improve reporting rates. Reports should be shared on a regular basis, with reporting institutions, atoll public health units and councils, in addition to policy-makers at the Ministry of Health.

In conclusion, Maldives has a well-functioning surveillance system for dengue. However, this study identified some gaps that should be improved in order to improve the sensitivity, acceptability and usefulness of the system, particularly in detecting outbreaks early.

After sharing the findings and recommendations of this evaluation with HPA, some changes were made to the surveillance system. Case definitions for DF, DHF and DSS were updated, in keeping with the WHO Regional Office for South-East Asia 2011 guidelines,[11] printed and sent out to all health facilities to display in the doctor's rooms and wards, and also posted on the Ministry of Health website. The communicable disease notification form was revised to enable collection of mandatory information with greater ease, and included answers that could be selected by tick-marks rather than writing, with specific instructions for completion. The new template was pre-tested, finalized and sent to all health facilities, and uploaded onto the Ministry of Health website, with instructions to use only this template and no other forms. The surveillance unit in HPA has communicated with WHO to improve the SIDAS online data-management system. Discussions are under way to improve laboratory surveillance.

HPA is also in the process of compiling a legal regulation for disease surveillance under the *Public Health Protection Act 7/2012*, and guidelines for disease surveillance to be used by health-care facilities. These will define the roles and responsibilities of health facilities, as well as clinical, support, medical records and public health staff, in the process of disease surveillance.

Staff capacity-building by expanding HPA and training for atolls is being conducted, and further training is planned to improve the functioning of the system.

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