

# Outbreak surveillance and response in humanitarian emergencies

WHO guidelines for EWARN implementation

Geneva, 2012

DISEASE CONTROL IN HUMANITARIAN EMERGENCIES



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The guideline was developed by a core group of experts from the TWG, the Guideline Development Group, and benefitted from the input of experts from WHO and partner organizations involved in EWARN systems in emergencies, including the United States Centers for Disease Control and Prevention (CDC), the London School of Hygiene and Tropical Medicine, Epicentre, the United Nations Office of the High Commissioner for Refugees, the United Nations Children's Fund, the European Commission Humanitarian Aid and Civil Protection (ECHO), the International Federation of the Red Cross and Red Crescent Societies, International Relief & Development, the Office of Foreign Disaster Assistance (OFDA) of the United States Agency for International Development (USAID), and the Training Programs in Epidemiology and Public Health Interventions Network.

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## **Abbreviations and acronyms**

AFP	acute flaccid paralysis
AWD	acute watery diarrhoea
CDC	United States Centers for Disease Control and Prevention
CFR	case-fatality ratio
CSF	cerebrospinal fluid
ECHO	European Commission Humanitarian Aid and Civil Protection
EPI	Expanded Programme on Immunization
EWARN	early warning alert and response network
HIV	human immunodeficiency virus
IHR/PHEIC	International Health Regulations/Public Health Emergencies of International Concern
IPD	in-patient department
MoH	ministry of health
NGO	nongovernmental organization
OCT	outbreak control team
OFDA	Office of Foreign Disaster Assistance
OPD	outpatient department
RDT	rapid diagnostic test
SMS	short message service
TWG	Technical Working Group
WASH	water, sanitation and hygiene
WHO	World Health Organization

## **Executive summary**

### **Background and objective**

Humanitarian emergencies often involve the displacement of large numbers of people. Those affected are frequently settled in temporary locations with high population densities, inadequate food and shelter, unsafe water, poor sanitation and lack of infrastructure. These circumstances can increase the risk of transmission of communicable diseases and other conditions, and can thus lead to increased mortality (death). In particular, diseases that have a tendency to become epidemic (referred to as epidemic-prone diseases) can be a major cause of morbidity (disease) and mortality during emergencies. Rapid detection and prompt response to epidemics among the affected population is a key priority during humanitarian crises.

During humanitarian emergencies, broad public health surveillance systems may be underperforming, disrupted or non-existent; they may quickly become overwhelmed to adequately meet surveillance information needs of a humanitarian emergency, including timeliness and high data quality. An early warning alert and response network (EWARN) is needed and is often set up to fill this gap, particularly in the acute phase of an emergency, while the routine systems recover from the effects of the disaster.

The World Health Organization (WHO) has produced guidance on surveillance and communicable disease control in emergencies; however, practical up-to-date operational guidelines are lacking. The purpose of this document is to provide a standard framework and best current practice for implementation of an EWARN and its operation in the field, following humanitarian emergencies.

EWARN is an adjunct, not a substitute for the national disease surveillance system, and once the acute emergency phase is over, it should be re-integrated into the national surveillance system.

### **Target audience**

These guidelines are intended for all individuals responsible for disease surveillance activities at all levels. These individuals include health facility staff, surveillance officers, epidemiologists, data analysts and statisticians, government health officials, sanitarians, managers of the Expanded Programme on Immunization (EPI), public health officers, laboratory personnel and community health workers.

### **Structure**

An EWARN is made up of a network of people who collect information, inform the next reporting level and implement any necessary control measures. It has two main components – an immediate alert component (which signals the early stages of an outbreak) and a weekly reporting component (which reports weekly data aggregated by health facilities). These complementary components ensure timely detection and verification of outbreaks, and effective monitoring of morbidity patterns.

### **Management**

Management of an EWARN involves a coordinator (typically an epidemiologist or public health expert with experience in disease surveillance and disease control in emergencies, and knowledge of surveillance systems and the local disease epidemiology) and at least one focal point assigned to each of the affected districts and provinces.



## **Surveillance network**

To gauge the occurrence of epidemic-prone diseases and unusual health events (e.g. unexplained deaths) in the emergency-affected area, an EWARN relies on a network of people responsible for the collection, investigation, reporting, analysis and dissemination of information from the field up the reporting chain to the central level. Facilities with well-trained staff and adequate resources can ensure complete, reliable and regular reporting.

The most robust network available should be used for initial roll-out of EWARN; this involves selection of health facilities that have adequate capacity for high-quality and reliable data. This phase should be followed by gradual expansion towards universal coverage as the remaining health facilities are strengthened and more resources become available.

## **Priority diseases**

During the acute phase of the emergency, it is helpful to undertake a systematic assessment of the risk of acute public health events; this involves gauging both the likelihood of a disease occurring and its eventual impact. For communicable diseases, the risk is associated primarily with the size, characteristics and living conditions of the displaced population. Where there is population displacement, the disease-specific epidemic risk and health impact also depend on the population's prior immune status in relation to the threat present at the place of arrival.

Certain diseases must be considered priorities and monitored systematically. Ideally, a maximum of 8–12 diseases or syndromes should be prioritized for inclusion in EWARN. A "case" definition must also be available for each disease or syndrome included in EWARN. To ensure that an outbreak is not missed, it is best if these definitions are relatively broad, but easily distinguishable from non-priority diseases.

Alerts are unusual health events that can signal the early stages of an outbreak. They can be detected at the community level (in the form of rumours), by setting an alert threshold and at the stage of data analysis. It is important to distinguish between epidemic-prone diseases and diseases of public health importance – the EWARN should focus on the former.

## **Data collection**

Alerts should be reported mainly in the quickest way possible. Weekly aggregated data of diseases that are a priority for the EWARN can then be extracted on a weekly basis from an outpatient register (Appendix 4) for recording all cases seen at a health facility. The primary principles for data collection include strict adherence to the case definition, universal coverage, links with existing vertical surveillance programmes and minimal data requirements.

Appropriate tools for data management, and (outpatient department) OPD and standardized data collection and reporting forms, will help to minimize data errors. Maintaining up-to-date records is also important for monitoring performance of EWARN and for performing validity checks and associated considerations (e.g. double counting, repeated patient visits, place of residence of patient and cross-border populations).

## **Data reporting and transmission methods**

Alert information, irrespective of its source, should be reported through the quickest means possible for verification and (if an outbreak is suspected) for outbreak investigation. The aggregated weekly EWARN data should be reported through the most predictable and appropriate methods available. Hand delivery of weekly reporting forms has been used, but this can be burdensome and may undermine EWARN performance.

Factors to take into account are frequency of reporting (immediate, daily or weekly) and reporting of mortality data.

## **Outbreak preparedness**

To respond effectively to outbreaks, it is essential to be prepared; for example, by forming a multisectoral outbreak control team (OCT), and by preparing items such as an outbreak response plan, standard line-list forms for data collection, standard treatment protocols for key diseases, and so on.

## **Alert verification**

Once an alert has been received by the EWARN district focal point or higher levels, a systematic verification process starting at the field level should be initiated within 24 hours. A standardized process should be used to verify the alert and, if an outbreak is confirmed, an on-site investigation should be started.

## **Outbreak investigation**

An outbreak investigation involves determining the cause of an outbreak and who is at risk, so that control measures can be implemented, thus reducing morbidity and mortality. It should begin as soon as an alert detected by surveillance has been verified. In the initial stage of an outbreak, the causative agent may not be known, and general control measures must be taken, based on the best available data. Once the cause has been confirmed, specific measures to control the disease can be undertaken.

## **Laboratory support**

Normally, routine reporting of EWARN syndromes does not require laboratory confirmation. However, for some diseases, such as malaria, confirmation through rapid diagnostic tests (RDTs) at the bedside may be essential for subsequent treatment. A regional or international reference laboratory must be identified at the onset of the emergency for more complex tests (e.g. for antimicrobial sensitivity or validation of RDTs).

## **Data analysis and interpretation**

The data from EWARN should be analysed, interpreted and used to inform public health interventions. Whether the alert mode is immediate notification or weekly aggregate data, analysis and feedback of the outcome are critical for continuity of information flow and to maintain the reporting process. Key EWARN indicators to generate from data analysis, for feedback and dissemination, include a range of parameters on the disease and the EWARN performance.

## **Feedback and dissemination**

Feedback is critical for ensuring full engagement of the stakeholders. Simplified language and graphs should be used to convey complex data and trends in a user-friendly format and, when possible, clear recommendations should be made to implementing organizations, highlighting priority areas and needs.

## **Setting up an EWARN**

The implementation of an EWARN system during the acute phase of an emergency does not follow a subscribed set of rules, because every setting and every emergency is different. However, implementation will involve an implementation team, rapid assessment, tools and equipment, reporting units, communication and briefing of the health cluster and ministries of health (MoH).

## **Training**

EWARN training should include formal organized training and continuing on-the-job training. Issues to consider are the people to be trained, the schedule and materials required.

## **Monitoring and supervision**

Ideally, within 3 weeks of the occurrence of a humanitarian emergency, there should be development and installation of an EWARN, recruitment and deployment of an EWARN coordinator, provincial and district EWARN focal points, training of all target groups of health workers and initiation of operation.

## **Evaluation**

A formal evaluation of an EWARN is not recommended within the first 3 months of implementation, because it requires funding, staff and time, which are better spent on setting up the EWARN. However, once the acute phase of the emergency has subsided, a formal evaluation should be carried out.

## **Exit strategy**

An EWARN should not continue to operate independently of, or in parallel with, the larger surveillance system once the emergency is over. A clearly agreed exit strategy and linkages to pre-existing surveillance systems should be elaborated in the initial EWARN proposal, incorporated into the EWARN workplan and clearly reflected in the projected budget.

## 1. Introduction

These guidelines have been developed in response to the need for practical operational guidance for implementation of an early warning alert and response network (EWARN) in the field after humanitarian emergencies. The World Health Organization (WHO) has produced guidance on surveillance and communicable disease control in emergencies; however, practical up-to-date operational guidelines are lacking. As a result, over the past 10 years, various versions of EWARN, or similar surveillance systems for communicable diseases, have been implemented during emergencies in numerous countries, using a range of methods and approaches. The purpose of this document is to provide a standard framework and best current practice for implementation of EWARN and its operation in the field, following humanitarian emergencies.

### 1.1 Background and objectives

Humanitarian emergencies, whether they are caused by conflict, natural disaster or food insecurity, are frequently characterized by the displacement of large numbers of people. Those affected are often settled in temporary locations with high population densities, inadequate food and shelter, unsafe water, poor sanitation and infrastructure that has been compromised or destroyed. These circumstances can increase the risk of transmission of communicable diseases and other conditions, and can thus lead to increased mortality (death). Diseases that have a tendency to become epidemic (referred to as epidemic-prone diseases), in particular, can be a major cause of morbidity (disease) and mortality during emergencies. Rapid detection and prompt response to epidemics among the affected population is a key priority during humanitarian crises.

The primary objective of an EWARN is to detect and respond rapidly to signals that could indicate outbreaks and clusters of epidemic-prone diseases in humanitarian emergencies. In terms of signals, an EWARN measures new cases or the "incidence" of a condition (a disease or syndrome) among patients presenting at a health-care facility, or as notified from the community – it gives only an approximation of what might be occurring at population level, and does not measure the full burden of a disease in a population. The signals that an EWARN detects should then prompt an investigation of whether an outbreak is occurring, so that control measures can be implemented as quickly as possible to prevent further cases and deaths.

The primary objective of an EWARN is to rapidly detect and respond to signals that might indicate outbreaks and clusters of epidemic-prone diseases.

An EWARN is implemented by a ministry of health (MoH) of the country concerned, with support from WHO and other partner agencies. In theory, all national public health surveillance systems should have an EWARN component to rapidly detect and control disease outbreaks, and to ensure compliance with the International Health Regulations (IHR) regarding Public Health Emergencies of International Concern (PHEIC).<sup>1</sup> However, during humanitarian emergencies, these broad public health surveillance systems may be underperforming, disrupted or non-existent. Thus, these systems may quickly become overwhelmed and unable to adequately meet surveillance information needs of a humanitarian emergency, when data timeliness and high quality are crucial. An EWARN is needed to

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<sup>1</sup> The International Health Regulations (IHR 2005) are a binding agreement signed by WHO Member States. The agreement obligates countries to prevent the international spread of disease by quickly detecting and responding to outbreaks. WHO is mandated to assist countries with fulfilling these obligations.

fill this gap, particularly in the acute phase of an emergency. The implementation of an EWARN can range from strengthening the existing early warning and response component of a routine surveillance system to implementing a completely new system if nothing appropriate is currently in place.

Following implementation in an acute humanitarian emergency, an EWARN sometimes persists as a stand-alone system for several years, as either a replacement for a non-functional national health system or a parallel system alongside the national system. An EWARN should be an adjunct to, not a substitute for, the national disease surveillance system. Once the acute emergency phase is over, the EWARN should be reintegrated into the national surveillance system or introduced as a component of a new routine national surveillance system, if this was absent before the emergency. Thus, the implementation strategy for an EWARN should be clearly linked to an exit strategy based on the country setting.

In some emergencies, non-epidemic conditions such as tuberculosis (TB), human immunodeficiency virus (HIV) and malnutrition have been included in an EWARN. The network does not lend itself to the collection of information relevant to the control of these diseases, such as the prevalence (proportion of population affected) of confirmed HIV and TB cases or malnutrition. However, given the significance of these non-epidemic conditions in humanitarian emergencies, appropriate alternative monitoring systems for these diseases should be put in place, while the EWARN focuses primarily on epidemic-prone diseases.

## **1.2 Target audience**

Various forms of EWARN have been implemented in humanitarian emergencies over the past decade. Often, however, the objectives and methodologies have been unclear, leading to confusion and a lack of clarity in the field. For example, data may have been collected but not consistently analysed, and opportunities to guide the public health response may have been missed. The effectiveness of communicable disease control during emergencies relies on a robust disease surveillance system that can produce useful, high-quality data. This current document attempts to standardize the approach to outbreak alert and surveillance in humanitarian emergencies, based on experience and available evidence, in a way that is sufficiently simple and flexible to be adapted to the local context.

The purpose of these guidelines is to provide a framework for implementation and operation of an EWARN in the field.

The guidelines address:

- using risk assessment to determine priority diseases for inclusion in EWARN;
- data collection and reporting procedures;
- preparedness for an outbreak;
- alert detection and verification;
- outbreak investigation and response;
- laboratory support;
- analysis and feedback.

The document is intended to support a common strategy that is consistent with current WHO guidance and in a format accessible for field use. It is intended for all individuals responsible for disease surveillance activities at all levels. These individuals include health facility staff, surveillance officers, epidemiologists, data analysts and statisticians, government health officials, sanitarians, managers of the Expanded Programme on Immunization (EPI), public health officers, laboratory personnel and community health workers.

### **1.3 Approach and methodology**

The development of these guidelines was informed by evidence gathered from:

- review of existing surveillance guidelines and protocols; 1,2,3,4,5,6,7
- desk reviews of past and current EWARN systems in different countries; 8
- formal field evaluations of EWARN experiences;
- expert opinion and experiences from national MoH, academic institutions and major international agencies involved in response to humanitarian emergencies through WHO-convened technical workshops.

The review of published literature on EWARN found a notable lack of publications on implementation and operation in emergencies in peer reviewed journals. The material that had been published was usually only descriptive. Possible reasons for this are that:

- EWARN implementation in acute humanitarian emergencies is a relatively new area of work and has been implemented by WHO and MoH with partner agencies only over the past 10–12 years;
- standard, agreed operational guidance is lacking;
- publication of interventions and experiences are not prioritized.

Given this situation, it was not possible to undertake a Grading of Recommendations, Assessment, Development and Evaluations (GRADE) review; instead, decisions for recommendations to be included in the guidelines were arrived at through consensus among technical experts.

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<sup>1</sup> *Technical guidelines for integrated disease surveillance and response in the African Region*, 2nd ed. WHO Regional Office for Africa, 2010 (<http://www.afro.who.int/en/clusters-a-programmes/dpc/integrated-disease-surveillance/features/2775-technical-guidelines-for-integrated-disease-surveillance-and-response-in-the-african-region.html>, accessed 28 November 2011).

<sup>2</sup> *Communicable disease control in emergencies – A field manual*. WHO, 2005 ([http://www.who.int/diseasecontrol\\_emergencies/publications/9241546166/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/9241546166/en/index.html), accessed 28 November 2011).

<sup>3</sup> *Middle East crisis. Guidelines for disease surveillance: early warning and response*. WHO, 2006 ([http://www.who.int/diseasecontrol\\_emergencies/publications/who\\_cds\\_ntd\\_dce\\_2006.6/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/who_cds_ntd_dce_2006.6/en/index.html), accessed 28 November 2011).

<sup>4</sup> *South Asia earthquake-affected areas. Operational plan and communicable diseases surveillance/early warning and response guidelines*. WHO, 2005 ([http://www.who.int/diseasecontrol\\_emergencies/publications/south\\_asia/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/south_asia/en/index.html), accessed 28 November 2011).

<sup>5</sup> *International health regulations (2005)*, 2nd ed. WHO, 2005 (<http://www.who.int/ihr/9789241596664/en/index.html>, accessed 28 November 2011).

<sup>6</sup> *A guide to establishing event-based surveillance* (2008). WHO Western Pacific Region, 2008 (<http://www.wpro.who.int/internet/resources.ashx/CSR/Publications/eventbasedsurv.pdf>, accessed 28 November 2011).

<sup>7</sup> Various WHO communicable disease profiles and toolkits, published from 2002 to 2007. See surveillance protocols in annexes for Afghanistan, Burundi, Democratic Republic of the Congo, Horn of Africa, Iraq, Liberia, Niger, Sierra Leone, Sudan and tsunami-affected areas. ([http://www.who.int/diseasecontrol\\_emergencies/toolkits/en/index.html](http://www.who.int/diseasecontrol_emergencies/toolkits/en/index.html), accessed 28 November 2011).

<sup>8</sup> *Disease surveillance systems in humanitarian emergencies: a desk-based analysis*. WHO DCE 2008. (Grey literature). (WHO Disease Control in Humanitarian Emergencies, unpublished).

To gather evidence, we used a number of strategies, including a scoping review of existing literature and guidelines on EWARN surveillance and response in emergencies, reports of EWARN evaluations, and experiences of implementing agencies and national governments. The first set of evidence was synthesized and presented to the first WHO Technical Workshop on EWARN in Emergencies, 7–8 December 2009.<sup>1,2</sup> The evidence included:

- information from existing literature and WHO guidance, as outlined above;
- desk review of EWARN in five countries (Albania, Chad, Iraq, Myanmar and Sudan);
- two formal field evaluations conducted in Darfur and South Sudan (based on a standard evaluation methodology);
- review of EWARN experiences from a range of organizations – Médecins Sans Frontières (MSF), the Health and Nutrition Tracking Service (HNNTS), the United Nations Office of the High Commissioner for Refugees (UNHCR), the International Federation of the Red Cross (IFRC) and the MoH Afghanistan (based on standard questions related to methodology and outcomes).

Following extensive discussion, consensus was reached among the participants on the evidence that would inform their recommendations.

The workshop was attended by technical experts from a range of organizations – the Australian National University (ANU), the United States Centers for Disease Control and Prevention (CDC), European Commission Humanitarian Aid and Civil Protection (ECHO), Epicentre, HNNTS, the Institut de Veille Sanitaire (INVS), IFRC, the London School of Hygiene and Tropical Medicine (LSHTM), MSF, the Office of Foreign Disaster Assistance (OFDA), Save the Children United Kingdom (SCF-UK), the Swedish Field Epidemiology Group, the Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET), the United Nations Children’s Fund (UNICEF), relevant offices of WHO Headquarters, and WHO’s regional and country offices. The main recommendations of the workshop were that:

- up-to-date operational guidelines based on the knowledge and experience of best practice to date are needed;
- a smaller core EWARN guidelines development group should be formed to develop the guidelines
- additional evidence should be gathered in the field from operating EWARN systems through formal expert evaluations.

The guidelines development group was therefore formed, with members from CDC, ECHO, IRD, LSHTM, MSF, UNHCR, UNICEF, TEPHINET and SCFEG to identify and evaluate additional sources of evidence, and to draft the guidelines.

Following the first face to face workshop, teleconferences and e-mail communication were used extensively for exchange of information and to draft EWARN guidelines among the members of the

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<sup>1</sup> *Early warning surveillance and response in emergencies: Report of the WHO technical workshop, 7–8 December 2009, WHO, Geneva, Switzerland.* WHO, 2009 ([http://www.who.int/diseasecontrol\\_emergencies/publications/who\\_hse\\_gar\\_dce\\_2010.4/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/who_hse_gar_dce_2010.4/en/index.html), accessed 28 November 2011).

<sup>2</sup> *Early warning surveillance and response in emergencies: WHO technical workshop, December 2009. Weekly Epidemiological Record.* 2010, 85:129–140 ([http://www.who.int/wer/2010/wer8514\\_15.pdf](http://www.who.int/wer/2010/wer8514_15.pdf), accessed 28 November 2011).

EWARN development group. A second WHO expert workshop was held in May 2011,<sup>1</sup> during which the draft operational guidelines were critically reviewed by the group of experts; results of two key expert evaluations conducted in Haiti after the 2010 earthquake and in Pakistan after the 2010 floods, and WHO EWARN (SPEED) implementation experience in the Philippines in 2010 were also presented and evidence assessed for inclusion in the draft guidelines at this workshop.

Evidence for the development of the guidelines included existing surveillance guidelines, review of best practice from EWARN implementation experiences including commissioning of formal evaluation of existing EWARN systems when information gaps were identified during the review process. Formal methods of evidence evaluation such as GRADE were therefore not appropriate. The EWARN guidelines development group, external partners and the steering group reviewed existing guidelines and best practice and evidence obtained informed recommendations for the operational guidelines. Evidence was reviewed and evaluated during the face-to-face meetings, teleconferences, and through e-mails exchanges. Decisions and recommendations were arrived at through consensus based on best evidence available. The more contentious issues were resolved during the Technical Workshop where such issues were deliberated upon extensively and agreement reached on the recommendations through consensus.

Declarations of interest (DOI) were collected from all members of the Guidelines Development Group. One member declared a potential conflict of interest relating to support received to enable participation at the meeting. On review of the DOI concerned it was considered that this did not represent a conflict of interest of relevance to this area of work.

These guidelines may be updated every 18–24 months as evidence evolves and new information on disease surveillance in humanitarian emergencies becomes available.

## **2. EWARN structure**

An EWARN (see Fig. 1) is made up of a network of people who:

- collect information on cases of epidemic-prone diseases, and unusual health events including deaths, in health facilities or in the community, using standardized tools (e.g. case definitions and alert thresholds) and forms;
- inform the next reporting level, so that appropriate action to verify and investigate a potential outbreak can be taken;
- implement any necessary control measures.

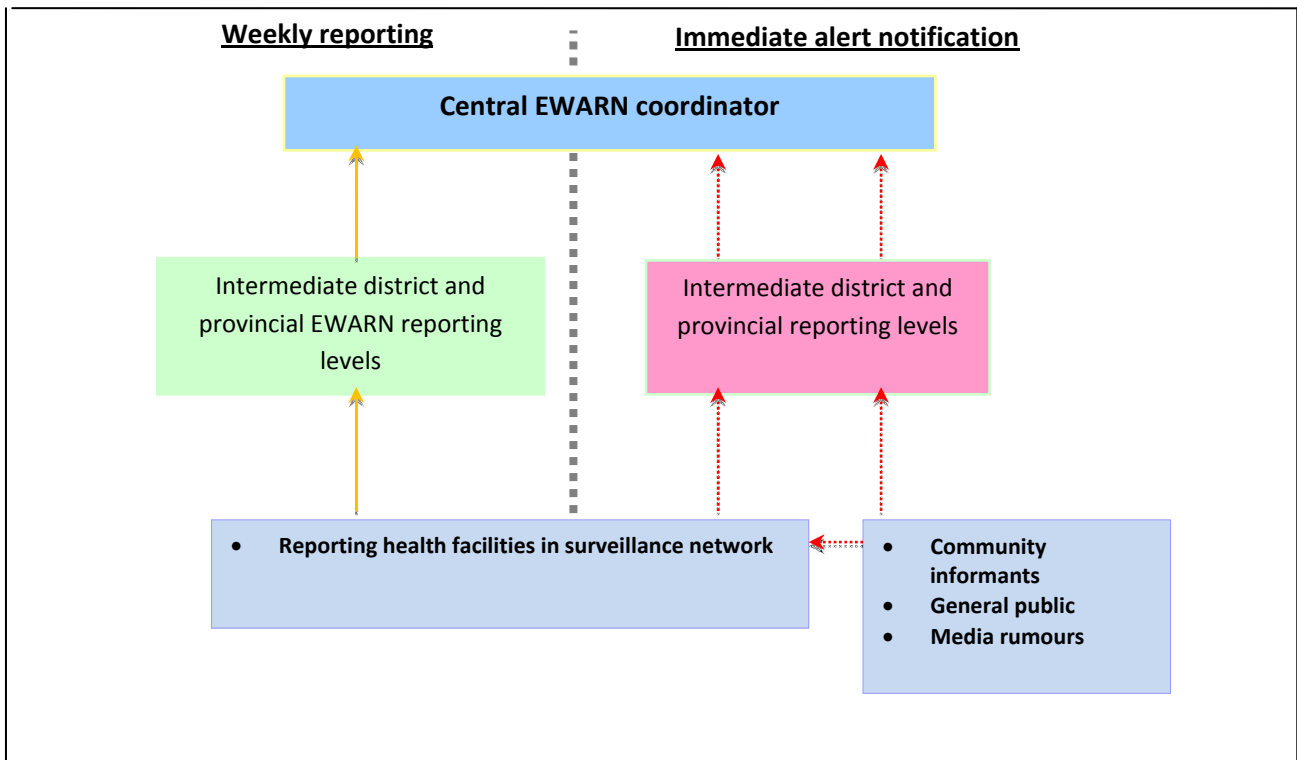
The system requires resources to record, transmit and manage data, as well as for transportation and adequate supervision for field investigation and rapid response to disease outbreaks.

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<sup>1</sup> *Early warning surveillance and response in emergencies. Report of the second WHO technical workshop, 10–11 May 2011 WHO, Geneva, Switzerland.* WHO, 2011 [http://www.who.int/diseasecontrol\\_emergencies/publications/who\\_hse\\_gar\\_dce\\_2011\\_2/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/who_hse_gar_dce_2011_2/en/index.html), accessed 28 November 2011).



**Figure 1: Data flow**



An EWAR has two main components:

- **Immediate alert component**  
Suspicion of an unusual health event (an alert) can signal the early stages of an outbreak in the community or in a health facility. This information should be immediately transmitted to EWAR focal points at intermediate district or provincial levels, or to the EWAR coordinator, for verification and possible field investigation, including a search for additional cases in the community, to determine appropriate control measures.
- **Weekly reporting component**  
Weekly data aggregated by health facilities are reported through the hierarchy of administrative levels (e.g. district, provincial) to the central coordinating level for analysis. Alerts that were not reported immediately, and those that rely on trend analysis (e.g. increased incidence of confirmed malaria), may be identified at the weekly analysis stage. Trend analysis of weekly data is also useful for monitoring impact of public health interventions in the community.

These components are illustrated in Figure 1. Alert notification hotlines, a weekly reporting mechanism (how and when weekly reports should be submitted) and a reporting schedule (on which day of the week reports should be submitted) must be clearly communicated to the reporting units.

Together, the two complementary components described above ensure timely detection and verification of outbreaks, and effective monitoring of morbidity patterns. The number of reporting levels may vary from one EWAR design to another, depending on the geographical scope (number of districts and provinces) and the number of people affected by a humanitarian emergency. Daily reporting of aggregated health facility data is not encouraged because of the enormous burden it places on the reporting health facilities, especially if data are mainly transmitted by hand delivery. The

exception is in the case of an established outbreak of a particular disease, where health facilities receiving such cases or deaths due to that outbreak should submit daily line lists to EWARN focal points.

## **3. EWARN management**

### **3.1 Coordinator**

An EWARN coordinator should be designated early in the acute phase of an emergency. The coordinator is typically an epidemiologist or public health expert with experience in disease surveillance and disease control in emergencies, and knowledge of surveillance systems and the local disease epidemiology. This person should provide dedicated technical oversight and supervision of EWARN at all levels, including reporting units, and district and provincial EWARN teams. EWARN coordinators should also work closely with local and international partners involved in public health efforts, to ensure optimal coordination between disease monitoring and continuing public health intervention among the crisis-affected population.

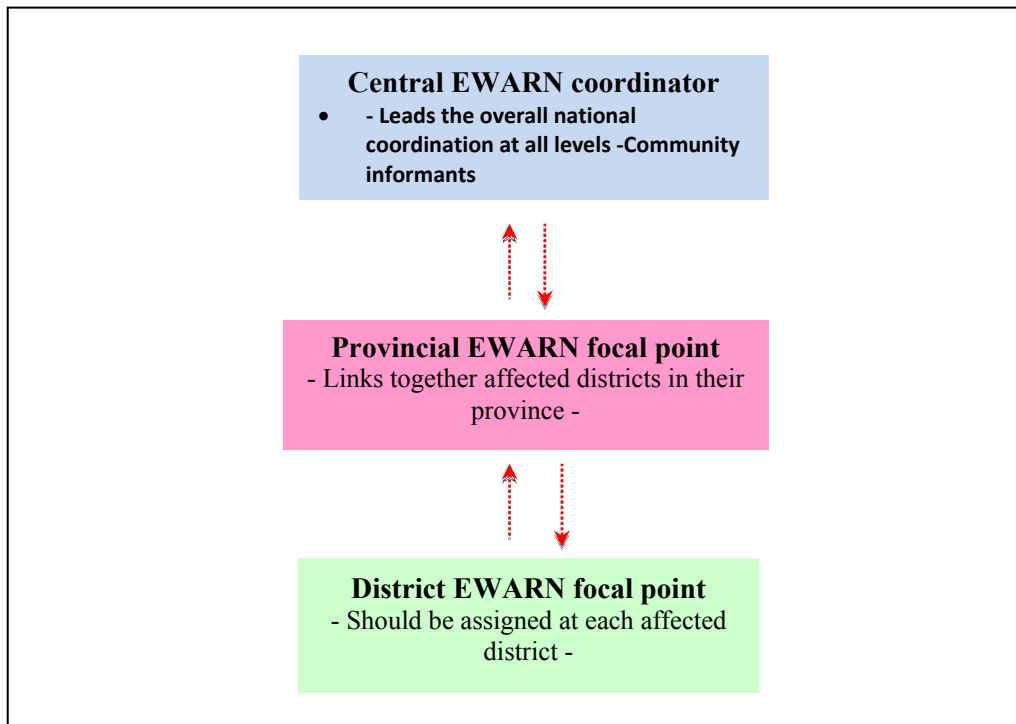
### **3.2 Focal points**

As shown in Figure 2, at least one person should be assigned as the EWARN focal point to each of the affected districts and provinces, based on the size of the geographical area or affected population. The minimum qualifications of an EWARN focal point include:

- at district level, a background in health and training in disease surveillance;
- at provincial level, a background in health, previous work experience in surveillance and training in epidemiology.

EWARN focal points should be supervised and coordinated by the EWARN coordinator. EWARN coordinators and their teams of provincial and district EWARN focal points should have no additional responsibilities outside EWARN.

Figure 2 EWAR management in emergencies of large geographical scale



#### 4. Surveillance network

In general, EWAR attempts to gauge the occurrence of epidemic-prone diseases and unusual health events (e.g. unexplained deaths) in the emergency-affected area. To do this, EWAR relies on a network of health-care providers, community health workers, surveillance officers, laboratory technicians, environmental or other specialists and epidemiologists responsible for the collection, investigation, reporting, analysis and dissemination of information, from the field up the reporting chain to the central level. Factors that can have a significant impact on the ability to measure trends are the number of reporting sites, periodicity of reporting, staff training, monitoring and supervision, application of the case definition and availability of laboratory support. Facilities with well-trained staff (e.g. clinicians, data manager and someone capable of data interpretation) and adequate resources can ensure complete, reliable and regular reporting.

Although surveillance of epidemic-prone diseases requires universal coverage (i.e. of all health facilities and community), the most robust network available should be used for initial roll-out of EWAR. Where there are resource constraints, a phased approach may be adopted, starting with inclusion of all health facilities in the immediate notification component of EWAR (which is less resource intensive), and a representative number of the health facilities in the weekly reporting component. The main focus of the phased approach for the weekly reporting component should be on high-quality data. Thus, the initial phase should start with selection of health facilities that have adequate capacity for high quality and reliable data. This phase should be followed by the gradual recruitment of the remaining health facilities towards universal coverage, as more resources become available and their reporting capacity is strengthened.

## **5. Priority diseases**

### **5.1 Risk assessment**

During the acute phase of the emergency it is helpful to undertake a systematic assessment of the risk of acute public health events; this involves gauging both the likelihood of a disease occurring and its eventual impact. Appendix 1 gives a three-step process for undertaking such a risk assessment. The assessment can identify the relatively few epidemic-prone diseases that have the potential to cause the greatest amount of morbidity and mortality in the affected population. To be most effective, EWARN should focus on these high-risk, epidemic-prone diseases. The findings of the risk assessment can be used to prioritize the surveillance efforts and interventions that will be most effective in mitigating the increased risk (a process referred to as risk management). Together, risk assessment and management can help to minimize morbidity and mortality in emergency-affected populations.

For communicable diseases, the risk is associated primarily with the size, characteristics and living conditions of the displaced population; specifically the:

- amount and availability of safe water, sanitation and hygiene facilities
- current health and nutritional status of the displaced population
- level of immunity to vaccine-preventable diseases, such as measles
- level of access to, and quality of, health-care services (see Appendix 2).

Where there is population displacement, the disease-specific epidemic risk and health impact also depend on the population's prior immune status in relation to the threat present at the place of arrival (e.g. a population from an area without malaria arriving in an area where malaria is endemic or epidemic, or a population arriving from an area that is non-endemic for cholera to an area that is endemic for this disease). The risk assessment process should be repeated as the emergency evolves, to account for changes (e.g. the sudden appearance of cholera in Haiti in 2010). The assessment should also consider other circumstances that could result in cases or deaths from other acute public health events, such as intoxications from food and chemicals.

### **5.2 List of diseases**

The risk assessment process will identify numerous conditions that pose a potential epidemic threat to the population. Experience from many emergency situations has shown that certain diseases must be considered priorities and monitored systematically. In formulating the list of priority diseases, criteria for inclusion should take into account:

- epidemic potential;
- ability to cause severe morbidity or death;
- international surveillance requirements (IHR/PHEIC);
- availability of prevention and control measures;
- availability of reliable and meaningful case definitions and simple laboratory tests, where appropriate.

Ideally, a maximum of 8–12 diseases or syndromes (which describe a set of symptoms and signs in a patient, and which can capture the conditions identified in the risk assessment) should be prioritized for inclusion in EWARN. Syndromes are used rather than diseases because they increase the likelihood that a certain category will actually capture all the people with a disease (since they describe the patient's set of symptoms rather than relying on making a diagnosis). The use of syndromes also increases the likelihood that health-facility staff will fill out the forms in a standard manner.

The common diseases or syndromes in EWARN include acute flaccid paralysis (poliomyelitis), acute haemorrhagic fever syndrome, measles, suspected cholera or acute watery diarrhoea (AWD), suspected shigellosis or bloody diarrhoea, acute jaundice syndrome, suspected bacterial meningitis and confirmed malaria.

### **5.3 Case definitions**

A "case" definition must be available for each disease or syndrome included in EWARN. To ensure that an outbreak is not missed, it is best if these definitions are relatively broad (i.e. sensitive) but easily distinguishable from non-priority diseases. Sensitive case definitions will necessarily generate many outbreak signals; the resulting verification and investigation process will then attempt to confirm or exclude these signals as an actual outbreak. False-positive signals due to low specificity are expected and tolerated. As in Section 5.2, defining syndromes is preferred to defining specific diseases, to ensure that cases of potential outbreak are not missed and to enable the generation of signals to be further investigated. Case definitions should also be simple, mutually exclusive and based on clinical symptoms; they should not rely on laboratory confirmation (with the exception of malaria).

#### **Box 1**

The case definitions given here are designed for surveillance purposes only. A surveillance case definition should not be used for case management and is not an indication of intention to treat. A case definition may change once an outbreak is detected (i.e. the outbreak case definition may differ from the surveillance case definition).

One syndrome can capture a range of epidemic-prone diseases; for example, acute jaundice syndrome could be caused by dengue, hepatitis A or E, yellow fever, leptospirosis and so on. However, case definitions should be sufficiently distinct to differentiate among conditions with similar clinical symptoms when some of those conditions are not of epidemic potential (e.g. to distinguish cholera from acute diarrhoea).

The national case definitions issued by the MoH should be used, if available. Frequently used case definitions and alert thresholds of priority diseases are given in Appendix 3. In areas where the pre-existing surveillance structure is absent or weak, it may be necessary to formulate standardized case definitions for EWARN. To ensure consistency in reporting, all surveillance reporters, regardless of affiliation, must use the same case definitions.

## **5.4 Alerts and alert thresholds**

Alerts are unusual health events that can signal the early stages of an outbreak. Alerts can be detected in three ways:

- at community level in the form of rumours originating from the community and in health facilities when health workers see patients (health facilities use alert notification thresholds that are set to allow appropriate notification);
- by setting an alert threshold for each disease or syndrome under surveillance that will provide early detection of potential outbreaks;
- at the data analysis stage, if changes in the trends of illness in the population suggest a possible disease outbreak.

Communities should be educated about important unusual health events (i.e. alerts) that should be reported immediately; for example, all members of one household having the same illness, or clusters of deaths in the community. Educational methods should be appropriate for that community, and key informants or influential members of the community should be identified and included in education efforts. Such people include pharmacists, school teachers, private health-care providers, village leaders, religious leaders, traditional healers and trained birth attendants.

There may be many alerts and the majority may not end up being outbreaks. Thus, every alert must be verified to determine whether or not it is a false alert. Although there are internationally accepted signals that constitute an alert for some conditions, there are no globally fixed criteria, and thresholds may need to be revised, based on the context and experience in each country (see Table 1).

**Table 1** Examples of alert thresholds for epidemic-prone conditions commonly included in EWARN

Condition	Alert threshold <sup>a</sup>
Acute flaccid paralysis (poliomyelitis)	One case
Acute haemorrhagic fever syndrome <sup>b</sup>	One case
Measles	One case
Suspected cholera <sup>c</sup> or acute watery diarrhoea (AWD) <sup>d</sup>	One case
Suspected shigellosis/bloody diarrhoea	Five or more cases in one location in 1 day or double the weekly average number of cases
Acute jaundice syndrome <sup>e</sup>	Five or more cases in one location in 1 week
Suspected bacterial meningitis	One case in a crowded camp setting or ≥30,000 people: five cases per 100,000 people per week; <30,000: two cases per week in the meningitis belt of Africa
Confirmed malaria	Twice the average number of cases seen in the previous 3 weeks

**Source:** Adapted from existing surveillance systems for example purposes only. List of priority conditions and alert thresholds must be adapted to fit regional context.

- a** See Section 5.4.
- b** May be a sign of haemorrhagic form of dengue, or other viral haemorrhagic fevers, among other conditions.
- c** Confirmed cholera should be reported as a separate category only where an outbreak has been confirmed and rapid diagnostic tests are available in the field.
- d** The term acute watery diarrhoea (AWD) is used in many settings to indicate suspected cholera because of the political sensitivity surrounding cholera outbreaks. In these settings, it is critical that the same case definition is used for both terms, emphasizing that one case denotes an outbreak.
- e** May be a sign of yellow fever, leptospirosis, hepatitis A, C or E, or severe malaria with liver function impairment, among other conditions.

## 5.5 Other considerations

The following section provides details on reporting of certain conditions in EWARN. This section was included to help clarify the difference between epidemic-prone diseases and diseases of public health importance. Previous EWARN evaluations have shown that confusion among these conditions is one of the primary reasons for the variable quality of data generated by the system. As part of the revision process, and in an attempt to improve EWARN, explanations of why certain conditions are included and others are not (or no longer) included are outlined below.

## Malaria

Malaria may be responsible for one of the highest proportions of morbidity and mortality in emergency settings. Even in highly endemic areas, population displacement may result in the re-emergence of malaria where it was once controlled, and an immunologically naïve population is at even greater risk. The National Malaria Control Programmes, supported by WHO, should ensure that appropriate rapid diagnostic tests (RDTs) for malaria are readily available in humanitarian emergencies. Malaria should only be included in EWARN if it has been confirmed by RDT or microscopy. The low positive predictive value of the clinical case definition for suspected malaria (i.e. even though someone might fit the clinical case definition, there is only a low chance that they have malaria) means that suspected malaria should not be included in EWARN.

### Box 2

The best predictor of a malaria epidemic is the slide positivity rate (SPR), which is the proportion of positive tests among all of the tests performed. In areas where microscopy is not available, RDTs are useful to aid diagnosis and guide public health action. Where RDTs are not available, syndromic case definitions are often used; however, interpretation of these data are challenging because of their lack of specificity.

## Diarrhoeal diseases

Diarrhoeal diseases in general are one of the most common illnesses in emergency-affected populations, especially among children. Most forms of diarrhoea are not an immediate threat and should not be included in EWARN. However, cholera and shigellosis can cause large epidemics and high mortality, and should be included. Limited laboratory testing capacity, and the political sensitivity that is often associated with a potential outbreak of cholera, have together resulted in varied and inconsistent categories to capture this information. For example, the terms AWD and suspected cholera have been used interchangeably in some reporting forms, whereas in others these terms have been separated. Also, AWD has been used to capture other forms of acute diarrhoea, not just acute watery diarrhoea.

It is important to ensure that case definitions for cholera and shigellosis are applied consistently and accurately in EWARN. Without consistent application of the case definitions and standardized reporting, large number of cases from one region could erroneously be considered a potential outbreak, while a few cases of a true outbreak from another area could be overlooked.

Some examples of potential issues are:

- suspected cholera or AWD:
  - *in an area where the disease is not known to be present*  
severe dehydration or death from acute watery diarrhoea in a patient aged 5 years or more;  
or
  - *in an area where there is a cholera epidemic*  
AWD with or without vomiting in a patient aged 2 years or more
- confirmed cholera (where testing is feasible):
  - a suspected case in which *Vibrio cholerae* O1 or O139 has been detected using an RDT



- suspected shigellosis or bloody diarrhoea:
  - a person who has diarrhoea with visible blood in the stool (preferably observed by a clinician rather than solely from the patient's report).

### **Acute respiratory infections**

Acute respiratory infections (ARI) are one of the most common reasons for seeking medical care. However, most uncomplicated cases of upper respiratory tract infections (URTIs), such as the common cold, resolve on their own and should not be included in EWARN. In addition, given the unlikelihood of being able to capture high-quality data on this condition in most reporting sites, the burden of ARI disease should be captured through methods other than EWARN. Selected well-functioning sites with attached laboratories could be designated as sentinel surveillance sites to assess the burden and causes of ARI. However, this is not a priority in an emergency, and can be addressed when a broader surveillance system is being re-established. If ARI is included in EWARN, it should concentrate on detecting lower respiratory tract infections (LRTIs) such as pneumonia, because these are more serious and are the leading cause of death among children under 5 years, particularly in sub-Saharan Africa. Also, LRTIs may capture signals related to outbreaks of respiratory diseases, such as influenza.

### **Malnutrition**

The main indicator for use in public health decision-making for malnutrition is prevalence, which is poorly captured by EWARN. Only new cases of malnutrition coming to a health facility are captured by EWARN, and these may not be representative of what could be a larger problem in the community. Furthermore, EWARN requires only one major diagnosis; thus, many cases of malnutrition may not be recorded in EWARN, because malnourished patients often present with other diseases (e.g. pneumonia or diarrhoea) that are more likely to be recorded. Therefore, acute malnutrition monitoring is best achieved through community-based surveys using measurements of mid-upper arm circumference and weight-for-height. Health workers should attempt to measure all children presenting at health facilities routinely, to ensure appropriate clinical and nutritional management of patients with malnutrition.

## **6. Data collection**

EWARN data comprise immediate reports of alerts and weekly reports of aggregated data. Sources of alerts data include:

- rumours generated from the community, from observation of unusual health events (e.g. unexplained deaths);
- alerts generated when health workers see patients and apply alert notification thresholds for specific priority diseases;
- data analysis that shows increasing population disease trends suggestive of an outbreak .

Alerts should be reported mainly in the quickest way possible, including phone calls and short message service (SMS) messages. Members of the community can also visit the nearest health facility to report an alert.

There must be an outpatient register (Appendix 4) for recording all cases seen at a health facility. Weekly aggregated data of diseases that are a priority for the EWARN can then be extracted on a weekly basis from the register to the standard reporting form (Appendix 5).

The primary principles for data collection include:

- *Strict adherence to the case definition.*  
Universal and accurate application of standard case definitions is critical. All health workers must be trained to distinguish clearly between diseases with similar syndromic signs and symptoms.
- *Universal coverage.*  
All health facilities serving the affected population should be included, at least in the immediate notification component of the EWARN, to avoid blind spots that could be a source of a major epidemic. For the weekly reporting component of the EWARN, depending on the capacity of the health facilities, it might not be possible initially to include all health facilities targeted for inclusion. Instead, it may be necessary to start with a few facilities and gradually expand coverage.
- *Links with existing vertical surveillance programmes.*  
Where there are surveillance programmes to eliminate specific diseases, such as acute flaccid paralysis (AFP) and Guinea worm, links should be made with these vertical programmes. These programmes tend to have an extensive network of community informants that the EWARN can tap into, to strengthen the community notification component and improve alert detection. However, this does not mean that Guinea worm should be included in EWARN.
- *Minimal data requirements.*  
To keep EWARN simple but still useful, the number of diseases and the information collected for each disease should be kept to a minimum. The EWARN system is not designed for complete accounting of disease incidence in the community at large, but rather to enable rapid detection of epidemics among those affected by humanitarian emergencies. A core set of variables should include case counts, two age categories (0–4 years, and 5 years and older) and applicable laboratory information, if available. Additional information may be useful for programme planning (e.g. sex information or smaller age categories), but this will not influence public health response efforts in the event of an outbreak during an acute emergency.
- *Appropriate tools for data management.*  
Accurate recording of data is important for adequate surveillance and an effective response. Standardized data collection and reporting forms will help to minimize data errors. Maintaining up-to-date records is also important for monitoring the performance of the EWARN and for performing validity checks. Basic tools include:
  - outpatient registers with diagnoses pre-printed, for legibility;
  - weekly reporting forms for weekly aggregated data;
  - outbreak investigation forms (see Appendix 6);
  - line-listing forms (see Appendix 7);
  - alert logs (see Appendix 8)

- *Additional considerations.*

The following situations must also be carefully considered during data collection:

- **Double counting**

To avoid double counting, each patient should be assigned only one main condition and counted only once. Data should either be collected from one source within a health facility (outpatient department, OPD) or cross-checked to confirm that patients were not counted more than once. For example, if a patient is diagnosed with suspected malaria in the OPD, sent to the laboratory for confirmation, and admitted to the inpatient department (IPD), this patient could be counted twice in the aggregation of data. Ideally, the IPD admission should be what is counted in this situation, because the fact that admission was necessary indicates severity of the disease.

- **Repeated patient visits**

Where possible, the number of new visits should be indicated separately from the total number of patient visits on tally sheets and registers, to estimate proportional morbidity and the overall workload of health facilities. To be able to calculate the proportional morbidity for each week, the number of *new* visits in that week due to *any* condition and the *total* visits (both new and repeat visits for any condition) need to be recorded, counted and reported. In the weekly form, the numbers for individual conditions should be for *new* cases only. The total number of daily visits for that week (including new and repeat visits, and diseases not under surveillance) can be entered in the last row of the weekly form, but do not need to be disaggregated by individual non-EWARN conditions.

- **Place of residence of patient**

The EWARN system records patients by place of consultation, which could be distant from their place of current residence or residence at the onset of disease, especially in situations where the health system is disrupted or there is continuous population displacement. Thus, each time an alert is identified, the field investigation team will need to check the health-facility records to list and map cases by place of origin, to help orient further outbreak investigation and attempts to find other active cases.

- **Cross-border populations**

When the affected population is living at the border between countries or autonomously managed regions within a federation of states, it is important to set up cross-border collaboration for information sharing and outbreak verification procedures, if feasible and acceptable. For example, this was done for cholera between the Dominican Republic and Haiti in 2010.

## 7. Data reporting and transmission methods

Alert information, irrespective of its source (e.g. the media, community rumours or health facilities), should be reported through the quickest means possible for verification and (if an outbreak is suspected) for outbreak investigation. Evidence gathered from the review of early warning surveillance during the Pakistan floods in 2010 indicated that the vast majority of outbreaks were detected by prompt alert notification. Community reporting of alerts can be improved by raising awareness of the need for it among affected communities (e.g. by community health workers and EWARN staff).

The aggregated weekly EWARN data should be reported through the most predictable and appropriate methods available. Hand delivery of reporting weekly reporting forms has been used, but this can be burdensome and may undermine EWARN performance.

## **7.1 Frequency of reporting**

The frequency of reporting different kinds of data is outlined below.

### **Immediate reporting**

Alerts generated from epidemic-prone diseases must be reported immediately using the fastest means possible. This also applies to any deaths or rumours of deaths from such conditions. In most situations, this will be via mobile phone calls or SMS text messages. In areas where mobile phone networks are non-existent, not well established or disrupted, other means of communication may be used (e.g. very high frequency [VHF] radios or satellite phones). A 24-hour hotline with voice call, SMS, fax and e-mail capabilities will facilitate immediate notification of alerts for timely verification.

### **Daily reporting**

Reporting of daily aggregated data of all priority diseases included in a EWARN is not recommended; rather, this should be done on a weekly basis. However, once an outbreak has started, daily reporting of the specific disease by all facilities in the affected area is expected. This is achieved through daily line listing of case and deaths, and submission of the line lists by the health facilities on a daily basis.

### **Weekly reporting**

Weekly reporting frequency for weekly aggregate EWARN surveillance data is recommended in humanitarian emergency. Reporting of weekly aggregated data should include “zero reporting” (i.e. placement of “0” against the condition) for conditions in which there were no cases; zero reporting avoids misinterpretation of the missing number. Summary data are important for analysis once an initial case (or alert) has been detected, and to monitor progression of a possible outbreak. Inclusion of summary data in the weekly epidemiological bulletin allows information sharing and advocacy among stakeholders and health partners, enabling emergency response efforts to be targeted appropriately. Weekly submissions can be paper-based or electronic (e.g. fax or e-mail).

## **7.2 Reporting of mortality data**

The EWARN system is not designed to produce accurate mortality rates. Therefore, EWARN data cannot be used to calculate mortality rates (either total or among children under 5 years of age)<sup>1</sup> in a population. EWARN is most useful for gathering morbidity data, which are usually collected from the OPD and IPD. Deaths occurring at a health facility will give an indication of the case-fatality ratio (CFR) for that disease at that facility. The CFR is an indicator of the quality of case management, late arrival at the facility or severity of disease.

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<sup>1</sup> As most deaths occur in the community, mortality data should come from community sources such as gravediggers and community leaders, but not from the EWARN, which is health-facility based. For more details see Checchi F. and Roberts L. Interpreting and using mortality data in humanitarian emergencies. *Humanitarian Practice Network, Network Paper 2005, 52* (<http://www.odihpn.org/documents/networkpaper052.pdf> accessed 28 November 2011).

In the case of a continuing outbreak of a specific disease (e.g. cholera), deaths must be included in the line list maintained by all health facilities receiving cases and deaths. Deaths occurring in the community from an outbreak must also be reported; however, without the equivalent reporting of cases in the community, an overall CFR cannot be deduced accurately, and facility and community CFRs should not be combined.

## **8. Outbreak preparedness**

To respond effectively to outbreaks, it is essential to be prepared.<sup>1</sup> Key preparations include:

- formation of a multisectoral outbreak control team (OCT), with roles and responsibilities designated for each team member;
- development of outbreak response plans (including reactive vaccination strategies where appropriate) for each priority epidemic-prone disease;
- development or updating (if necessary) of standard line-list forms for data collection during an outbreak;
- development and distribution of standard treatment protocols for key diseases, with strategies for training of staff;
- calculation of potential attack rates for epidemic-prone diseases, where possible;
- pre-positioned stockpiles of essential treatment supplies to initiate outbreak control (e.g. oral rehydration salts, intravenous fluids, vaccination material, personal protective equipment, transport media for samples, water purification supplies and information leaflets on preventive measures for health staff or the community);
- procurement of laboratory sampling materials for the priority diseases, and identification of a competent laboratory for confirmation of cases;
- identification of potential sites for isolation and adequate treatment of patients, or for extra capacity in the event of a surge in cases (e.g. a cholera treatment centre);
- implementation of relevant prevention tools based on the risk assessment of diseases (e.g. indoor-residual spraying of dwellings and distribution of long-lasting insecticide-treated nets to prevent malaria outbreaks).

## **9. Alert verification**

Once an alert has been received by the EWARN district focal point or higher levels, verification must occur immediately, and measures to control the detected outbreak must be put in place quickly, to minimize morbidity and mortality. A systematic verification process, starting at the field level, should be initiated within 24 hours of notification, regardless of the source (health facility or rumour within the community). A standardized process should be used to verify the alert and, if an outbreak is confirmed, an on-site investigation should be started. Comprehensive records should be kept of the reported alert, the verification and the results of the outbreak investigation. Appendix 9 has further details on this process.

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<sup>1</sup> Adapted from *Communicable disease control in emergencies: a field manual*. World Health Organization, 2005.

Alert verification is necessary to determine whether a site visit is needed. The verification can be done by telephone and can include the collection of information about:

- case definitions used;
- symptoms and signs of cases (to verify the diagnosis and consider differential diagnoses);
- date of onset of symptoms of the first and the most recently detected cases;
- place and date of consultation or hospitalization;
- age, sex and vaccination status of patients, where relevant;
- place of residence at onset of illness;
- where cases are occurring (community-level data);
- geographical, personal and time relationships between cases (e.g. house of residence, family setting, place of work or school, district, whether they attended the same event, and whether they occurred in a specific health facility where the treating health staff member has also become ill);
- outcomes including, for example, deaths, case management details and the health-care staff affected.

### **Box 3**

All alerts (reported cases or unexpected deaths from epidemic-prone diseases) should be documented using an alert log (see Appendix 8). All alerts must be verified and outbreaks investigated within 24 hours using a standardized case-investigation form and an approved specimen collection method (see Appendix 10). Information recorded in an alert log should include alert notifications, investigations, outcomes or results of investigation or specimen testing, and follow-up actions with dates and times. The log should be maintained at each site and all levels (facility, district and provincial) and submitted with the weekly report (see Appendix 8). This will assist tracking of the sensitivity and positive predictive value of the alert, and of the timeliness of the response.

## **10. Outbreak investigation**

Outbreak investigation involves determining the cause of an outbreak and who is at risk, so that control measures can be implemented. It differs from alert verification (determining whether an outbreak is actually occurring), but is a continuation of the process of characterizing an unusual health-related event in which there is an increase in cases above an expected baseline. The main objective of an outbreak investigation is to control the outbreak and thus reduce morbidity and mortality. The investigation should begin as soon as an alert detected by surveillance has been verified (Figure 3).

The steps involved in an outbreak investigation are covered in detail elsewhere<sup>1</sup> but are summarized below. The steps do not necessarily happen in this sequence, but outbreak control measures should be implemented as soon as possible. In the initial stage of an outbreak, the causative agent may not be known, and general control measures must be taken, based on the best available data. Once the cause has been confirmed, specific measures to control the disease can be undertaken. The steps are to:

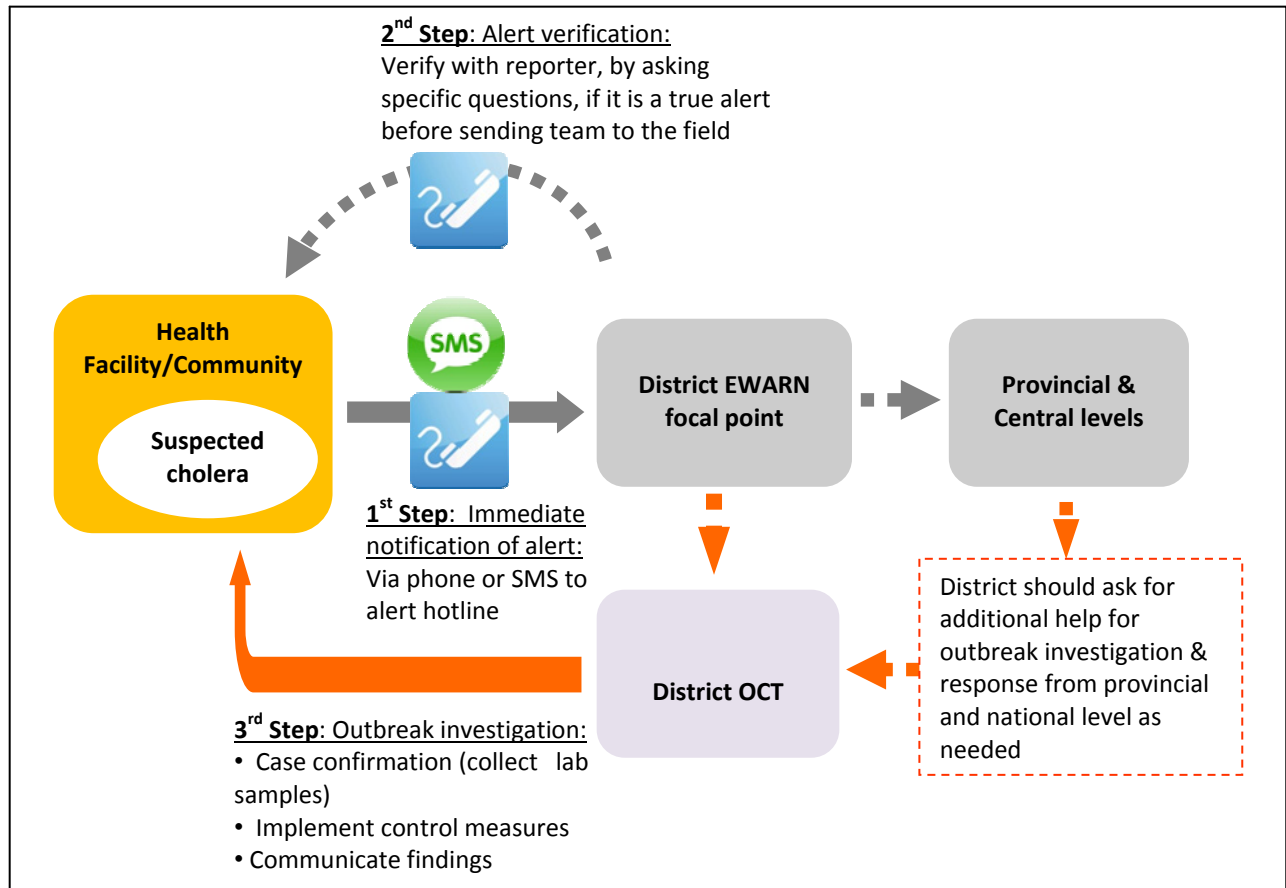
- verify initial reports and thus establish whether an outbreak is occurring;
- personally examine cases if possible, or discuss signs and symptoms with an attending clinician;
- visit the household, place of work or school, and interview possible contacts of the case where appropriate;
- collect blood, stool and cerebrospinal fluid (CSF) samples in relevant media (e.g. on Cary–Blair medium for suspected cholera), as appropriate; perform rapid tests where indicated; order laboratory tests to confirm the diagnosis;
- perform environmental sampling, where appropriate;
- develop a case definition for the purposes of the outbreak, which should:
  - include time, person and place;
  - include simple and easily identified symptoms that balance sensitivity and specificity;
  - be more specific (usually) than the case definitions used during routine surveillance;
- establish the extent of the outbreak by counting cases, if possible by place of residence (preferably the place of residence at the onset of disease);
- ensure line listing of cases by all health facilities receiving cases;
- expand the EWARN coverage and increase reporting as required (e.g. daily submission of line lists to the next reporting level by all health facilities receiving cases);
- perform descriptive epidemiology, including an epidemic curve, to determine whether cases are clustered in time, place or by person (e.g. by age and sex);
- develop hypotheses explaining exposure and disease (e.g. the source of the outbreak and the mode of transmission; these are often obvious from descriptive epidemiology);
- refine the hypothesis and carry out additional studies, including laboratory tests and environmental studies;
- implement control measures as soon as possible (these may change from general to specific measures as the investigation progresses and the epidemiology is refined);
- develop and communicate public health messages in the affected community;
- evaluate hypotheses (formal epidemiological studies may be needed to further define risk and refine control methods);
- communicate the findings of the outbreak investigation (this step may be undertaken earlier);

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<sup>1</sup> Gregg MB, *Field Epidemiology*, 2nd ed. Oxford University Press, 2002.

- prepare a written report.

**Figure 3 Steps in the process of notification and verification of alerts, and investigation and outbreak response**<sup>1,2,3</sup>



## 10.1 Constitution of an outbreak control team

Outbreaks frequently expand beyond the health sector to become multisectoral, and thus severely strain the health system. Coordination among sectors – for example, the water, sanitation and hygiene sector (WASH) or the nutrition sector – is crucial to ensure a comprehensive and effective response. The occurrence of an outbreak can often be a sensitive event and may be complicated by political ramifications; hence, close liaison is necessary among relevant technical, political and communication partners.

An OCT includes a range of skills and expertise for an effective outbreak response. A typical composition of an OCT is outlined below, but this may need to be expanded or modified depending on the suspected disease, available resources and required control measures.

<sup>1</sup> *Communicable disease control in emergencies: a field manual*. World Health Organization, 2005.

<sup>2</sup> *Technical guidelines for IDSR in the African Region*, 2nd ed. World Health Organization, 2010.

<sup>3</sup> Gregg MB, *Field Epidemiology*, 2nd ed. Oxford University Press, 2002.



The expertise of OCT members may include:

- team leader or event manager;
- surveillance coordinator;
- clinician;
- laboratory technician ;
- water, sanitation or environmental health specialist;
- vector control specialist;
- veterinary epidemiologist if appropriate;
- representative of the local health authority;
- anthropologists or health educators;
- community leaders;
- communication specialist;
- logistician.

## **10.2 Outbreak management**

Managing an outbreak involves monitoring the evolution of the outbreak and any control measures implemented, and undertaking overall coordination of the response. Once an outbreak is confirmed, the role of the OCT includes:

- ensuring that health facilities in the outbreak-affected areas update and transmit a line list of cases and deaths to the next coordination level, on a daily basis;
- reviewing, on a daily basis, the line-list data on suspected cases and deaths from all health facilities, and following up increases in incidence in affected areas or any rumours of cases in new areas, so that control measures can be targeted;
- reviewing the number of hospitalizations (admissions), health-facility CFRs, triage and admission criteria, and use of standard treatment protocols, to ensure correct case management;
- identifying and coordinating deployment of additional human and material resources for managing the outbreak (e.g. treatment sites, surveillance, vaccination, case management, behavioural and social interventions, risk communication and training of clinical workers);
- continually monitoring the coverage and appropriateness of control measures;
- ensuring information management and appropriate communication with the media, public, donors and other stakeholders;
- coordinating with the local (and national) authorities, nongovernmental organizations (NGOs) and United Nations agencies.

## **10.3 Common control measures**

Outbreak control measures are targeted based on evidence gathered during outbreak investigation. Measures include interruption of transmission, protection of those at risk and treatment of those with disease. Some common interventions include:

- interruption of environmental sources (e.g. provision of safe water, adequate sanitation and shelter, and establishment of standard infection control precautions in health-care facilities);
- removal of people from exposure (e.g. initiation of social distancing measures in the case of influenza);
- modification of host response (re-establishment or strengthening of vaccination, treatment of cases and provision of prophylactic chemotherapy);
- inactivation or neutralization of the pathogen (e.g. water treatment measures);
- isolation of infected people, to prevent spread and to optimize case management within adapted specialized health facilities (e.g. for diseases such as Ebola and cholera);
- reduction of vector transmission (e.g. elimination of breeding sites, larviciding, spraying of insecticide in health facilities and communities, distribution of long-lasting insecticide-treated nets and implementation of environmental hygiene, depending on local vector species);
- improvement of personal hygiene and food handling procedures (e.g. through health education, provision of soap and adequate access to safe water);
- removal of source of contamination (in case of intoxication);
- behavioural and social interventions, including limitation of social or mass gatherings, control of funeral procedures (e.g. for cholera or haemorrhagic fevers), systematic cleaning and disinfection of market places, and forbidding small-scale improper water selling (cholera, etc.);
- risk communication.

## 11. Laboratory support

Normally, routine reporting of EWARN syndromes does not require laboratory confirmation. For some diseases, such as malaria, confirmation through RDTs at the bedside may be essential for subsequent treatment. There are RDTs not only for malaria, but also for cholera, dengue, diphtheria, hepatitis A and E, leptospirosis, measles or rubella, bacterial meningitis, shiga-toxin-producing *Escherichia coli* and *Shigella* spp., and typhoid fever.

Although EWARN reporting is based on syndromes, laboratory confirmation of suspected cases is important when an outbreak is suspected. A regional or international reference laboratory must be identified at the onset of the emergency for more complex tests (e.g. for antimicrobial sensitivity or confirmation of RDTs). Laboratory sample collection should be carried out at the most peripheral level; often this is at the district level. There must be an efficient mechanism for correctly recording, packaging and safely transporting samples from the patient to the laboratory, and for transmitting results back to the EWARN team and the clinical workers. The EWARN team, in conjunction with the MoH, is responsible for setting out sample collection methods, the type of samples collected, tests conducted, the transport requirements (e.g. media, safety boxes and cold chain), and identification of the relevant laboratories, including complete addresses (see Appendix 10). An updated log of samples submitted for laboratory testing, their results and follow-up action must be maintained. Putting these standard operating procedures and contact details of reference laboratories in writing will ensure optimum specimen management across the EWARN reporting sites.

Ready-to-use forms to collect patients' informed consent for specimen collection and analysis should also be available. Because of the occupational risks of sampling, the EWARN team must ensure that training, equipment and packaging are appropriate.

If a certain pathogen, source or mode of transmission is suspected, control measures should not be delayed if laboratory confirmation is not yet available. In the absence of confirmation, initial control measures should be implemented and epidemiological information should continue to be collected, as this will help to guide any changes in control measures.

## 12. Data analysis and interpretation

The data from EWARN should be analysed, interpreted and used to inform public health interventions. An EWARN produces two types of information: alert signals (detection of a single case or a change in trends in weekly aggregate data) and weekly aggregate data for monitoring trends. Immediate notification from reporting facilities upon detection of alerts (originating from health-facility interactions or community rumours) is the primary method of detection of most outbreaks.<sup>1</sup> In addition, outbreaks of certain diseases (e.g. confirmed malaria), may be detected from trend analysis of weekly aggregate data. Whatever the alert mode, analysis and feedback of the outcome of the alert verification process and weekly aggregate data are critical for continuity of information flow and to maintain the reporting process.

Aggregation of data should be at the most peripheral level, most often at district level. Aggregation at more central levels can mask the fine detail that is useful to initiate public health action.

Key EWARN indicators that should be generated from data analysis for feedback and dissemination are outlined below.

### 12.1 Disease parameters

The disease parameters generated should include the following:

- Incidence of disease by place of consultation (new cases per number of population per week, when population is known), with a graph including previous weeks to show the trend. This can also be assessed by age group and location. In many settings, accurate calculation of incidence is severely limited by inaccurate population data, and total number of cases seen should be presented instead.
- Proportional morbidity (cases of disease divided by total cases and expressed as a percentage), with a graph including previous weeks to show the trend. This is useful when the population denominators are unknown or changing.
- Number of cases of any potentially epidemic disease.
- CFRs (deaths due to specific disease or syndrome divided by total cases of that disease or syndrome and expressed as a percentage), especially during outbreaks, with a graph including previous weeks to show the trend.
- Attack rate during outbreaks (cumulative incidence (new cases) of epidemic disease in a population over a particular period of time, when population is known).

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<sup>1</sup> *Early warning surveillance and response in emergencies. Report of the WHO technical workshop, 7–8 December 2009, WHO, Geneva, Switzerland.* World Health Organization, 2009 ([http://www.who.int/diseasecontrol\\_emergencies/publications/who\\_hse\\_gar\\_dce\\_2010.4/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/who_hse_gar_dce_2010.4/en/index.html), accessed 28 November 2011).

## **12.2 EWARN performance parameters**

The EWARN performance parameters that should be generated include:

- number of reporting sites per week, with a graph that includes previous weeks, to show the trend;
- completeness and timeliness of reports (e.g. proportion of reports received per week), with a graph including previous weeks, to show the trend;
- proportion of alerts:
  - responded to within 24 hours from notification (number with response within 24 hours divided by all alerts in given time frame, expressed as a percentage);
  - where laboratory sampling was done (number of alerts with samples received divided by all alerts in given time frame, expressed as a percentage);
  - confirmed as outbreaks (number of alerts that were confirmed outbreaks divided by all alerts in given time frame, expressed as a percentage);
- details of specific alerts: when, where, response initiated, outcome and mapping, as appropriate.

## **13. Feedback and dissemination**

Feedback is critical for ensuring full engagement of the stakeholders. In addition, to inform disease control efforts, information providers must be included in feedback. Weekly EWARN surveillance summaries should be presented and reviewed at both the health and WASH (and other relevant) cluster meetings to further engage partners involved in the multisectoral response and to share information with them. Decision-makers or staff at local, national and international levels who review this information may not be trained in epidemiology, so simplified language and graphs should be used to convey complex data and trends in a user-friendly format. When possible, clear recommendations should be made to implementing organizations. These recommendations should highlight priority areas and needs; for example, increasing numbers of diarrhoeal disease cases in a particular camp may highlight water and sanitation needs in that area, and can guide specific interventions.

## **14. Setting up an EWARN**

The implementation of an EWARN system during the acute phase of an emergency does not follow a subscribed set of rules, because every setting and every emergency are different. Although several distinct steps are described in this section, the implementation of an EWARN will be a dynamic process, and the various steps may occur simultaneously or in varying order, even though the overall process and procedures will be similar.

### **14.1 Implementation team**

The implementation team:

- is responsible for designing and implementing the EWARN (usually WHO leads this effort in support of the MoH and in collaboration with other international partners);
- should include representation from the MoH, to ensure timely consensus and implementation of the EWARN;

- should include an epidemiologist, a communicable diseases specialist, a local health official and an information technology (IT) specialist to adapt and install relevant EWARN software and hardware.

## **14.2 Rapid assessment**

The team should:

- identify the priority epidemic-prone diseases to include in EWARN, based on the findings of the risk assessment and on standardized case definitions;
- determine the geographical scope of surveillance;
- assess the status of key surveillance infrastructure, including existing surveillance capacity (e.g. functioning national health information system, emergency component, network of community health workers, previous EWARNs, and other specific surveillance programmes such as for AFP);
- identify resource needs for EWARN implementation, including staff with relevant skills (see Appendices 12 and 13), communication and IT equipment (see Appendix 13), laboratory support and vehicles.

## **14.3 Tools and equipment**

The team should:

- use standardized forms – case definitions, reporting forms, alert investigation forms, laboratory forms, registers, pre-printed patient case history forms and alert log registers;
- provide standard operating procedures and a checklist (see Appendix 14) for carrying out surveillance activities and for monitoring EWARN performance;
- ensure that districts and provinces have at least one laptop computer (laptops are preferred to desktop computers because of unpredictable power supply in most districts in the developing countries where EWARN is often required) and a software program, such as Microsoft Excel, for data compilation and analysis;
- ensure that central coordination includes one personal computer (PC) for each member of the EWARN team (team leader, national public health officer, data manager and data assistant), the EWARN software programme and Internet connectivity (note: there are no hardware or software requirements for reporting units);
- use contacts with health coordinators of NGOs – in meetings, cluster meetings, mailing lists (e.g. a Google group), at training sessions and during supervision visits – to distribute reporting tools to all health facilities recruited in the network of reporting units.

## **14.4 Reporting units**

A variety of reporting units will be involved:

- The team should recruit all functional health facilities in the affected area – permanent public health facilities, ad-hoc temporary health facilities, mobile clinics and, if needed, therapeutic feeding centres and private health facilities – to ensure universal coverage of the affected

population, initially for the alert component, if resources limit installation of the weekly reporting component in some health facilities.

- NGO-supported health facilities may have better communication capacity and staffing and are often among the first to be operational.
- Weekly reporting units should be steadily expanded as more of the remaining units are strengthened and added to the network; eventually, all health facilities should be included.

## **14.5 Communication**

The team should establish appropriate and reliable communication methods for reporting of alerts and weekly aggregate data, and for providing regular feedback to all stakeholders (e.g. national authorities and health professionals involved in the emergency and reporting units). To establish such methods, the team should:

- dedicate one cell-phone line for each district, province and central coordination level, for voice or SMS alert notification – EWAR focal points and the EWAR coordinator are the responsible and main contact people for EWAR hotlines, and the hotline should be included in the EWAR reporting forms;
- set up an EWAR e-mail address for transmission of reports – these should be included in the EAWRN reporting forms;
- install facilities for receiving reports sent by fax at provincial and central level;
- prepare an EWAR box for any reports delivered by hand;
- identify who will be responsible for collecting and delivering alerts and reports, regardless of means by which they are collected and delivered;
- establish a reporting schedule, with the day of the week and time of day when reports should be provided to be compliant;
- maintain an updated list of reporting sites, including new sites and mobile sites, and any that close during the life of the EWAR;
- provide regular epidemiological information feedback during health and WASH cluster meetings;
- obtain e-mail addresses of all stakeholders in the EWAR and set up a mailing list (e.g. a Google group) for sharing weekly bulletins.

## **14.6 Briefing of health cluster and MoH**

In briefing the health cluster and MoH, the team should:

- define geographical units for data compilation, and prepare maps to allow visualization of the distribution of health facilities that are part of the EWAR reporting system;
- include all health facilities participating in EWAR;
- provide a list of priority diseases to report on, based on the risk assessment, case definitions and alert thresholds;
- explain the need for immediate notification of any alerts and of the weekly case count for the trend monitoring components of the EWAR;
- provide and indicate where all standardized forms can be obtained electronically;

- provide a weekly reporting schedule: day, time and place (e.g. for physical forms, e-mail, SMS and radio);
- instruct on how to report an alert through the hotline (giving the information needed from the reporter);
- provide EWARN e-mail and alert hotlines for immediate reporting and for any actions to be taken in response (phone verification followed by field investigation);
- provide information on when data will be analysed and by whom, which indicators will be reported, and the day feedback will be given and how;
- decide the expected composition of the OCT during disease outbreaks;
- determine supervision of EWARN, including the frequency of reporting and the people responsible for reporting;
- set up EWARN training and orientation of health workers (i.e. decide who will do it and when);
- establish laboratory support for EWARN activities (i.e. decide who collects specimens and how); if RDTs are to be used, determine how to obtain and store these, and what training (if any) will be needed for their use.

#### **Box 4**

All levels of government, especially at district level, must ensure that all government and NGO health facilities registered to provide health care in their jurisdiction participate in and facilitate EWARN activities. This includes educating the affected communities in their area of operation on how to report immediate notifiable events, suspected disease outbreaks and unusual health events. Individual NGOs may collect additional data relevant to their programme needs in the health facilities they support, but everyone providing patient care must participate in the EWARN, using standard EWARN tools.

## **15. Training**

EWARN training should include formal organized training and continuing on-the-job training. Participants in formal training should include EWARN focal points, NGO health coordinators and reporting units. It is important to start with EWARN focal points, who should assist with the training of lower levels to ensure rapid scaling up and conclusion of training. Formal training is not recommended for community members – it is not feasible given the sheer numbers. However, selected key community informants may be included in training for EWARN focal points and NGO health coordinators.

### **15.1 Schedule**

Priorities for the training schedule should be established; a phased approach may be adopted, as follows:

- **Phase 1:** The EWARN implementation team trains provincial focal points and NGO health coordinators.
- **Phase 2:** Provincial focal points, supported by the EWARN implementation team, train district EWARN focal points.
- **Phase 3:** Provincial and district focal points train reporting-unit staff for scaling up within 1 week, to ensure that all reporting units start reporting by the end of the training week. In each reporting unit, at least the doctor in charge and paramedical staff, in charge of completing the surveillance forms, should be trained.
- **Phase 4:** Provincial and district focal points train relevant community leaders and partners.
- Continuing on-the-job training should start as soon as the EWARN becomes operational. This is particularly useful in an emergency context, where turnover of trained health workers tends to be high. Opportunities for on-the-job training include scheduled staff meetings for EWARN focal points and NGO health coordinators, and supervision and monitoring visits to health facilities and the affected community. Health workers directly involved in care delivery should also be encouraged to share relevant health messages, including the need to report unusual health events in the community (e.g. several members of a family coming down with the same disease, or a cluster of deaths in a single neighbourhood).

## 15.2 Materials

Standard EWARN training modules should be developed and adapted to address key functions of each reporting level (from community or health facility to central coordination level).

The training module for EWARN focal points and NGO health coordinators should include both theoretical and practical elements:

- risk factors for various diseases in the environment and among the affected population;
- characteristics of pathogens causing disease in the area covered by the EWARN;
- management of alerts and weekly reporting data;
- common epidemiological analytical outputs and their implication for prevention and control;
- methodology for investigating an outbreak;
- emphasis on the role of these people in supervision, monitoring and on-site refresher training.
- The training module for reporting units should have more hands-on, practical content; for example:
  - how to keep proper records in a register;
  - how to tally the relevant data from the register;
  - how to complete and transmit the EWARN weekly reporting form;
  - how alerts should be reported (i.e. as soon as detected by a health worker, using the mobile phone hotline provided), and what details should be shared with the EWARN focal point for alert verification;
  - emphasis on case definitions, alerts and alert thresholds.
- The community education module should focus on:
  - community awareness and knowledge of priority diseases;



- potential sources of community information for informal alerts – pharmacists, school teachers, private clinics, village leaders, religious leaders, traditional healers, trained birth attendants or other community health workers;
- where and how to report unusual health events – by phone or SMS to the hotlines, or verbally to the nearest health facility or community health worker.

## **16. Monitoring and supervision**

Ideally, within 3 weeks of the occurrence of a humanitarian emergency, there should be:

- EWARN development and installation, including procurement of essential medical and laboratory supplies (including personal protective equipment);
- recruitment and deployment of an EWARN coordinator, and provincial and district EWARN focal points, with clearly defined roles and responsibilities (see Appendix 12);
- training of all target groups of health workers;
- initiation of operation.

Optimal continuing EWARN operation is achieved through close monitoring and supervision. This is particularly important in the early stages after its implementation, to identify gaps in EWARN functions and application of corrective measures.

To ensure continuing optimal performance, EWARN focal points at all levels must clearly understand their monitoring and supervision roles, the specific activities that need to be undertaken at each level, and the expected EWARN performance standards. EWARN performance at every level – from central to provincial, provincial to district, district to reporting unit, and reporting unit to the community – must be monitored regularly and supported to ensure that functions are executed correctly, and to identify any difficulties they may be encountering.

Supervision and monitoring visits should be conducted using a standard supervisory checklist (see Appendix 14) to ensure consistency among all health facilities in the network (both government- and NGO-operated). The checklist also serves as a record of the visit and highlights key reporting unit activities to be reviewed during the visits, including:

- spot checks of the OPD register for timeliness and completeness of reporting of alert and weekly reports;
- access to, and use of, standardized forms;
- links with community;
- knowledge and correct application of case definitions and alert thresholds;
- use of the laboratory to confirm disease outbreaks;
- support given to the reporting units during such visits, including on-the-job training of new staff or of current staff, based on gaps identified.

## **17. Evaluation**

A formal evaluation of an EWARN is not recommended within the first 3 months of implementation. Evaluations are resource intensive in terms of funding, staff and time, and it is not advisable to divert

these resources at the critical time when the EWARN is being set up and becoming functional. Once the EWARN is operational, improvements may certainly be needed (e.g. in data quality). Necessary improvements should be identified through effective monitoring and supervision, and subsequent corrective measures taken.

Once the acute phase of the emergency has subsided, a formal evaluation should be carried out (see Appendix 15). Evaluation findings can provide critical feedback for revision of EWARN guidelines.

## 18. Exit strategy

As outlined above, an EWARN is an adjunct and not a substitute for the national surveillance system. It should not continue to operate independently of, or in parallel with, this larger surveillance system once the emergency is over. Thus, it is critical that a clearly agreed exit strategy and linkages to pre-existing surveillance systems are elaborated in the initial EWARN proposal, incorporated into the EWARN workplan and clearly reflected in the projected budget. If initial plans for phasing out the EWARN or merging it with existing systems are revised, such actions should be justified and discussed with all relevant stakeholders, including donors.

How and when to transition will depend on in-country capacity:

- ***Presence of an existing and functional national health information system of good quality***  
The EWARN should be discontinued and reintegrated into the existing system once the acute phase of the emergency is over. Ideally, this should be within 12 months of the establishment of the EWARN. During the initial phase, a projected end date should be agreed with government health authorities, to facilitate this transition, and resources should be allocated towards amalgamating the two systems.
- ***Absence of an existing and functional national health information system of good quality***  
Establishing a new surveillance system may take several months to several years following an emergency. If the EWARN is the only source for epidemiological data, it needs to continue until a health information system is fully operational. However, the new surveillance system must also include plans to incorporate the EWARN, as an emergency arm, into the new health information system. Funding should include provision for converting it to the new system. Lack of a national system should not serve as a reason for the EWARN to operate indefinitely; rather, it should be an incentive to switch over as soon as feasible.
- ***Existing EWARN (previous emergency)***  
Many countries experience multiple emergencies over time. Although an EWARN is intended to be implemented for a limited time after an emergency, remnants of an older EWARN version may still be in use in certain areas when a new EWARN is needed. Efforts must focus on delineating the two systems to prevent duplication (i.e. use of both versions) or expansion of the previous version in lieu of the current one (i.e. adding conditions or variables). Individuals involved in previous emergencies and accustomed to an older EWARN system may not view the new EWARN as an independent entity (e.g. because it may have fewer health priorities, revised case definitions or different reporting methods). The tendency will be to revert to, or modify, the previous form to fit current needs. Simple changes such as a different name (e.g. Disease Early Warning System [DEWS] rather than EWARN) or a different coloured form can help differentiate between the old and the new systems.

## Glossary of terms

Note: All terms marked ‘\*’ are from *Principles of epidemiology in public health practice*, 3rd Edition. Public Health Foundation, November, 2006.

### **Alert**

Occurrence of a priority epidemic-prone disease or syndrome.

### **Alert threshold**

Pre-defined number of alerts that suggest the beginning of a possible disease outbreak and therefore warrant immediate notification.

### **Alert verification**

Systematic assessment of the validity of an alert.

### **Case**

An instance of a particular disease, chronic condition or type of injury. A variety of criteria may be used to identify cases, and the epidemiological definition of a case is not necessarily the same as the ordinary clinical definition.\*

### **Case definition**

A set of standard criteria for determining whether a person has a particular disease or health condition. A case definition specifies clinical criteria and details of time, place and person.\*

### **Case-fatality ratio**

The proportion of people with a particular condition (case-patients) who die from that condition. In calculating case-fatality ratios, the numerator is the number of people who die from the condition and the denominator is the total number of people with the condition.\*

### **Cluster**

An aggregation of cases of a disease or other health condition that are closely grouped in time and place. The number of cases may or may not exceed the number expected, and frequently the expected number is not known.\*

### **Endemic health condition**

A disease, chronic condition or type of injury that is constantly present in a given geographic area or population group; may also refer to the usual prevalence of a disease or condition.\*

### **Environmental factor**

An extrinsic factor, such as geology, climate, insects, sanitation or health services, that affects an agent and the opportunity for exposure.\*

### **Epidemic (synonym: outbreak)**

The occurrence of more cases of a particular type of disease, chronic condition or injury than expected in a given area, or among a specific group of people, over a particular period of time.\*

### **Epidemic-prone disease**

A disease likely to cause an epidemic or disease outbreak.\*

**Formal source**

Disease occurrence information originating from the health system, including from community and facility-based health workers.

**Incidence**

The frequency of occurrence of new cases in a population.

**Informal source**

Disease occurrence information originating outside the health system, including from members of the public and the media.

**Line list**

List of cases including relevant patient information (e.g. demographic information and date of onset of disease) used to monitor a suspected or confirmed disease outbreak.

**Morbidity**

Disease; any departure, subjective or objective, from a state of physiological or psychological health and well-being.\*

**Mortality rate**

A measure of the frequency of death in a defined population during a specified time interval.\*

**Outbreak** (*synonym: epidemic*)

Because the public sometimes perceives "outbreak" as less sensational than "epidemic", the former is sometimes the preferred word. Sometimes, the two words are differentiated, with "outbreak" referring to a localized health problem and "epidemic" to one that takes in a more general area.\*

**Outbreak investigation**

Actions taken to confirm diagnosis and to verify an outbreak.

**Outbreak preparedness**

A state of having key resources and capacities in place for optimal outbreak response.

**Post-disaster epidemiological risk assessment**

An assessment of the effect of a humanitarian crisis on local endemic diseases, population and environmental factors and how they could affect the risk of disease transmission.

**Prevalence**

The number or proportion of cases or events or conditions in a given population.\*

**Proportional morbidity**

The proportion of morbidity in a population attributable to a particular cause over a period of time. Each cause of morbidity is expressed as a percentage of all causes of morbidity, and the sum of proportional morbidity for all causes must equal 100%.\*

**Public health surveillance**

The systematic and continuing collection, analysis, interpretation and dissemination of health data. The purpose of public health surveillance is to gain knowledge of the patterns of disease, injury and other health problems in a community so as to work towards controlling and preventing them.\*

**Reporting unit**

The primary source of surveillance data; health facilities where patients seek care.

**Risk**

The probability that an individual will be affected by, or die from, an illness or injury within a stated time or age span.\*

**Risk factor**

An aspect of personal behaviour or lifestyle, an environmental exposure or a hereditary characteristic that is associated with an increase in the occurrence of a particular disease, chronic condition or injury.\*

**Rumours**

Unverified information regarding disease occurrence received from informal sources.

**Sensitivity**

The ability of a system to detect epidemics and other changes in the occurrence of health problems; the proportion of people with a health problem who are correctly identified by a screening test or case definition.\*

**Specificity**

The proportion of people without a particular disease, chronic condition or type of injury who are correctly identified by a screening test or case definition.\*

**Surveillance reporter**

Health worker at community or at facility level who reports alerts or regular surveillance data.

## Appendix 1

### Communicable disease transmission risk assessment in humanitarian emergency settings

The risk factors that influence disease transmission in emergency settings should be assessed systematically. These factors can be grouped together and viewed by disease category (e.g. waterborne diseases, vector-borne diseases and diseases associated with crowding or malnutrition) to link interventions to specific risks.

A three-step process, outlined below, is used to assess risk of outbreaks in humanitarian emergencies.<sup>1</sup>

- **Event description** is the process of systematically assessing the type of emergency and the characteristics of the population displaced. The size of the displaced population, the duration of the displacement and other factors can influence the risk of transmission of communicable diseases.
- **Threat or vulnerability assessment** identifies potential interactions between the emergency-affected population (host factors), likely pathogens (agents) and exposures (environment) that determine factors that facilitate communicable disease transmission.
- **Risk characterization** takes into account all aspects of risk – the potential magnitude of the health impact and the likelihood of the event occurring.

The diseases listed below are commonly encountered in humanitarian emergency settings; the list is not intended to be exhaustive. Nor are all the syndromes and diseases listed here meant for immediate alerts or weekly reporting.

Diseases linked to poor water and sanitation	Diseases associated with overcrowding	Vector-borne diseases
All diarrhoeas including cholera, shigellosis and typhoid	Acute respiratory infections/pneumonia	Crimean–Congo haemorrhagic fever
Acute respiratory infections	All diarrhoeal diseases	Dengue
Hepatitis A, E	Hepatitis A, E	Japanese encephalitis
	Influenza	Malaria
	Measles	Relapsing fever
	Meningitis	Rift Valley fever
	Tuberculosis	Scrub typhus
		Yellow fever

The potential for transmission of communicable diseases is influenced by a complex interplay of host, agent and environment. Accurately defining risk requires a careful consideration of the potential interactions of all three factors – in the case of an emergency, within the specific context of the area and population affected by the emergency. Based on the overall risk assessment, interventions for disease control are prioritized by evaluating additional factors such as cost, technology, availability and infrastructure requirements.

<sup>1</sup> *Communicable disease risk assessment: Protocol for humanitarian emergencies*. World Health Organization, 2007.

## Appendix 2

### Risk factors for selected communicable disease transmission in emergency settings<sup>1</sup>

Disease or syndrome	Risk factors
Dengue haemorrhagic fever	Dengue haemorrhagic fever endemic area Vector breeding sites (e.g. water pools, water accumulation sites such as tyres or water storage containers)
Diarrhoeal diseases or hepatitis A, E	Overcrowding Inadequate quantity or quality of water (or both) Poor personal hygiene Poor washing facilities Poor sanitation Insufficient soap Inadequate health-care services
Leptospirosis	Contamination of water by rat urine Contact with infected domestic and other animals (e.g. dogs or rats) Inadequately treated drinking-water sources Poor hygienic conditions in shelters and immediate environment
Malaria and other vector-borne diseases (Japanese encephalitis, scrub typhus, Crimean–Congo haemorrhagic fever)	Movement of people from areas of low endemicity to hyperendemic areas Exposure to areas where vectors are present Lack of shelter Interruption of vector control measures Inadequate health-care services Stagnant water (rain) Seasonal changes in weather patterns (rains)
Measles	Measles immunization coverage rates < 80% in area of origin Population movement Overcrowding Malnutrition
Meningococcal meningitis	Overcrowding High rates of acute respiratory infection
Zoonoses (Crimean–Congo haemorrhagic fever, Rift Valley fever or brucellosis)	Poor control of slaughtering Contact with infected animals due to lack of veterinary control Increased rate of diseases in animals

<sup>1</sup> *Communicable disease control in emergencies – a field manual*. World Health Organization, 2005 ([http://www.who.int/diseasecontrol\\_emergencies/publications/9241546166/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/9241546166/en/index.html), accessed 28 November 2011).

## Appendix 3

### Suggested case definitions and alert thresholds

Disease	Case definition and information	Alert criteria
Suspected acute flaccid paralysis (poliomyelitis)	Any child < 15 years with acute flaccid paralysis  <b>OR</b> any paralytic illness in a person of any age if poliomyelitis is suspected	One case
Acute haemorrhagic fever syndrome	Acute onset of fever of less than 3 weeks duration in a severely ill patient <b>AND TWO</b> of the following signs: <ul style="list-style-type: none"> <li>▪ haemorrhagic or purpuric rash</li> <li>▪ bleeding from the nose (epistaxis )</li> <li>▪ vomiting blood (haematemesis)</li> <li>▪ coughing up blood (haemoptysis)</li> <li>▪ blood in stools</li> <li>▪ other haemorrhagic symptom and absence of predisposing host factors for haemorrhagic manifestations</li> </ul>	One case
Suspected measles	Any person with fever <b>AND</b> maculopapular (non-vesicular) generalized rash <b>AND ONE</b> of the following: cough, runny nose (coryza) or red eyes (conjunctivitis)  <b>OR</b> any person in whom a clinician suspects measles	One case
Suspected cholera/AWD	Any person 5 years or older with severe dehydration or death caused by acute diarrhoea (three or more abnormally loose or fluid stools in the past 24 hours)  During a cholera epidemic, any person 2 years or older with acute diarrhoea (three or more abnormally loose or fluid stools in the past 24 hours), with or without dehydration	One case
Acute jaundice syndrome	Acute onset of jaundice (yellowing of whites of eyes or skin or dark urine) <b>AND</b> severe illness with or without fever <b>AND</b> the absence of any known precipitating factors	Five or more cases in one location  or  double the weekly average number of cases seen in the previous 3 weeks for a particular location
Suspected meningitis	Any person with sudden onset of fever (>38.0 °C axillary) <b>AND ONE</b> of the following signs: <ul style="list-style-type: none"> <li>▪ neck stiffness</li> <li>▪ altered consciousness</li> <li>▪ petechial or purpural rash</li> <li>▪ Other meningeal signs (severe neck stiffness causing the patient's hip and knees to flex when the neck is flexed, severe stiffness of the hamstrings causing inability to straighten the leg when the hip is flexed 90 degrees)</li> </ul> <p>In children &lt; 1 year, meningitis is suspected when fever is accompanied by a bulging fontanel</p>	One case in a crowded camp setting  Or  Population > 30,000: five cases per 100,000 people per week  population < 30,000: two cases per week in endemic countries of the meningitis belt of Africa



Suspected shigellosis/bloody diarrhoea	A person with diarrhoea (three or more abnormally loose or fluid stools in the past 24 hours) with visible blood in stool (preferably observed by the clinician)	Five or more cases in one location or double the weekly average number of cases seen in the previous 3 weeks for a particular location
Confirmed malaria	Positive laboratory confirmation by blood smear or rapid diagnostic test for malaria	Twice the average number of cases seen in the previous 3 weeks for a particular location
Acute haemorrhagic fever syndrome	<p>Acute onset of fever of less than 3 weeks duration in a severely ill patient <b>AND TWO</b> of the following signs:</p> <ul style="list-style-type: none"> <li>▪ haemorrhagic or purpuric rash</li> <li>▪ bleeding from the nose (epistaxis)</li> <li>▪ vomiting blood (haematemesis)</li> <li>▪ coughing up blood (haemoptysis)</li> <li>▪ blood in stools</li> <li>▪ other haemorrhagic symptom and absence of predisposing host factors for haemorrhagic manifestations</li> </ul>	One case

## Appendix 4

### Sample OPD register

Serial no.	Name	Age	Sex (M/F)	Address (sub-district and village or city neighbourhood)	First visit for this problem (Y/N)	Main clinical presentation or diagnosis	Treatment	Remarks (eg referral, transfer patient or samples collected)

## Appendix 5

### Sample health facility weekly reporting form

Form #:
---------

Reporting date	From: __/__/____ To: __/__/____	Province	
Submitted by		District	
Submission date		Village or settlement	
Contact number		Health-facility name	
Organization name		Health-facility code	
Catchment population		Health-facility type (circle one)	Health post Hospital      Health centre Other

Disease – new visits only	Code	Cases	
		0–4 years	≥ 5 years
Acute flaccid paralysis (poliomyelitis)	AFP		
Acute haemorrhagic fever syndrome	AFS		
Suspected measles	MS		
Suspected cholera/AWD	SC		
Suspected shigellosis/bloody diarrhoea	BD		
Acute jaundice syndrome	AJS		
Suspected bacterial meningitis	MG		
Confirmed malaria	MAL		
Other disease (Specify) .....			
Unusual cluster of events			
<b>All other patients seen with conditions not under surveillance, including repeat visits</b>			

Report alert cases immediately to tel: xxxxxxxxxx. Do **NOT** wait for end of the week

- See **alert thresholds** to determine whether to notify immediately
- Please include only those cases that were seen during the surveillance week. **Each case should be counted only once.**
- Write "0" (zero) if you had no case during the week for one of the syndromes listed in the form.
- See case definitions and alert thresholds at the back of this form.

**Deaths reported from the community**

Number of deaths	Suspected cause	Ages	Investigation (select one)
			Yes / No / Pending
			Yes / No / Pending
			Yes / No / Pending

**Deaths that occurred in the inpatient facility (fill only if in inpatient facility)**

Name	Age	Sex	Place of residence (village or town)	Suspected cause

## Appendix 6

### Sample outbreak investigation form

Report completed by: ..... District or area: ..... Town, village, settlement or camp: ..... Health facility: ..... Agency: ..... Date: ...../...../.....	
Name of reporting officer and when received: ..... Brief summary of the initial report: ..... ..... ..... .....	
<b>Suspected disease or syndrome:</b> <b>(tick one item only)</b>	<b>Symptoms and signs:</b> <b>(you can tick several items)</b>
<ul style="list-style-type: none"> <li>▪ Suspected measles</li> <li>▪ Suspected meningitis</li> <li>▪ Acute jaundice syndrome</li> <li>▪ Acute flaccid paralysis (AFP) /suspected poliomyelitis Suspected cholera/AWD</li> <li>▪ Suspected shigellosis/bloody diarrhoea</li> <li>▪ Confirmed malaria</li> <li>▪ Other</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fever</li> <li>▪ Rash</li> <li>▪ Other skin lesion (specify .....)</li> <li>▪ Neck stiffness</li> <li>▪ Convulsions or seizures</li> <li>▪ Altered level of consciousness</li> <li>▪ Jaundice (yellowing of eyes and/or skin)</li> <li>▪ Muscle weakness</li> <li>▪ Acute watery diarrhoea</li> <li>▪ Bloody diarrhoea</li> <li>▪ Dehydration</li> <li>▪ Vomiting</li> <li>▪ Bleeding (specify location.....)</li> <li>▪ Cough</li> <li>▪ Malaria Rapid Diagnostic Test positive</li> <li>▪ Other (specify): .....</li> </ul>
<b>Total number of cases reported:</b> <b>Actions taken:</b>	

## Appendix 7

### Sample health facility outbreak monitoring line-listing form

Case No.	Age	Address	Sex (M/F)	Date of onset (dd/mm/yy)	Lab specimen taken <sup>1</sup> and lab register number	Treatment given (Yes/No)	Outcome <sup>2,3</sup>	Final diagnosis

<sup>1</sup>Laboratory specimens: B = Blood, S = Stool, C = CSF, U = Urine, O = other

<sup>2</sup>Outcome: I = Currently ill, R = Recovering or recovered, D = died

<sup>3</sup> Known contact with previously identified case (list case no.)

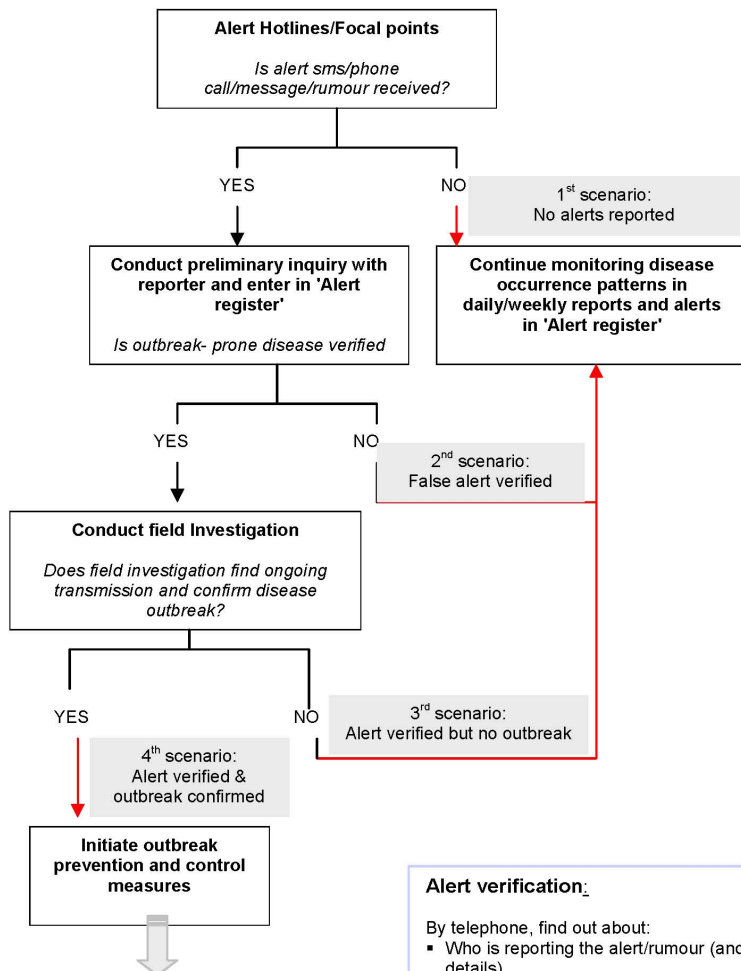
## Appendix 8

### Sample alert monitoring log

Reported alert	Date of report and by whom	Alert details Who is affected? Where is the affected area? When was the initial occurrence? How many are affected? Are deaths reported?	Alert update as of (date and time)	Actions taken (including name of who has taken action, time and date, and specify action taken)	Remarks	Status of the alert Ongoing Closed

## Appendix 9

### Algorithm for alert verification and outbreak investigation for use by EWARN focal points/surveillance officers



#### Four possible alert scenarios

- 1. No alerts reported:**  
E.g. Alerts seen in weekly reports but not reported immediately as expected; this can also be known with regular supervision  
**Possible actions:**  
Orientation/training on alerts and recommended notification thresholds; check communication lines to ensure non-reporters can communicate with EWARN focal points
- 2. False alert on verification:**  
E.g. SMS alert is received from community health worker of suspected measles; verification process reveals isolated case of skin disease and not measles  
**Possible actions:**  
Re-orientation on case-definitions as part of supportive supervision; positive feedback on use of EWARN
- 3. Alert confirmed & no outbreak**  
E.g. A health facility reports meningitis case, confirmed on verification and field investigation suggest no ongoing transmission  
**Possible actions:**  
Probably a sporadic case of meningitis, emphasis on optimal treatment of the case and immediate notification of any new cases; positive feedback on use of EWARN
- 4. Alert verified & outbreak confirmed**  
E.g. Health facility reports unusual numbers of acute watery diarrhoea among adults with severe dehydration. Verification and field investigation confirms an outbreak of severe diarrhoeal disease, possibly cholera  
**Possible actions:**  
Outbreak response measures initiated  
Laboratory samples taken for confirmation and antibiotic sensitivity.

#### Outbreak response components:

- **Characterize the epidemiology:** line listing; descriptive epidemiology, epidemic curve, CFR, hypothesis regarding transmission
- **Laboratory confirmation:** control measures should not await laboratory results; antimicrobial sensitivity should support case management.
- **Prevention:** e.g., community prevention messages, immunization, prophylaxis of contacts, social mobilization
- **Control:** Interrupt transmission, isolate/manage cases

#### Alert verification:

- By telephone, find out about:
- Who is reporting the alert/rumour (and their contact details)
  - Person/Place/Time
    - Numbers of cases/deaths
    - Age, Sex, Origin of cases/deaths
    - Date of onset or consultation
  - Treatment and outcome
  - Check case definition used and symptoms/signs exhibited
    - Any healthcare staff affected
    - Any clusters (by family or contacts, geographically)
    - Measures taken so far
    - Community reactions

*Note: all the above may not be known by the person reporting the alert, but can help in deciding whether an alert is false or not, and will help orient a field investigation if needed.*

#### Field investigation:

- On-site visit, preferably within 24 hrs
- Review of cases with clinicians
- Assessment clustering of cases in time and space
- Household visit
- Examination of cases, interviews case contacts
- Interview to determine medical history, review of vaccination records
- Performance of rapid tests as indicated
- Collection samples in relevant media
- Line listing of cases
- Expansion of surveillance coverage and enhancement of reporting as required



## Appendix 10

### Specimen collection

#### A. Blood specimen collection

Blood and separated serum are the most common specimens taken in outbreaks of communicable disease. Venous blood can be used for isolation and identification of the pathogen in culture by inoculation, or separated into serum for the detection of genetic material (e.g. by polymerase chain reaction), specific antibodies (by serology) and antigens or toxins (e.g. by immunofluorescence). For the processing of most specimens for diagnosis of viral pathogens, serum is preferable to unseparated blood, except where otherwise directed. When specific antibodies are being assayed, it is often helpful to collect paired sera (i.e. an acute sample at the onset of illness and a convalescent sample 1–4 weeks later). Whenever possible, blood specimens for culture should be taken before antibiotics are administered to the patient, but life-saving treatment should not be unnecessarily delayed.

#### Venous blood samples

##### *Materials for collection*

The following materials are required:

- skin disinfection: 70% alcohol (isopropanol, ethanol) or 10% povidone iodine, swabs, gauze pads and adhesive dressings;
- disposable latex or vinyl gloves;
- tourniquet, Vacutainer or similar vacuum blood collection devices, or disposable syringes and needles;
- Vacutainer or sterile screw-cap tubes (or cryotubes if indicated) and blood culture bottles (50 ml for adults, 25 ml for children) with appropriate media;
- labels and indelible marker pen.

##### *Method of collection*

Full infection control measures must be taken, with gowns, gloves, masks and boots, for suspected viral haemorrhagic fever (e.g. Lassa fever or Ebola):

- Place a tourniquet above the venepuncture site. Disinfect the tops of blood culture bottles.
- Palpate and locate the vein. The venepuncture site must be meticulously disinfected with 10% povidone iodine or 70% alcohol by swabbing the skin concentrically from the centre of the venepuncture site outwards. Let the disinfectant evaporate. Do not palpate the vein again. Perform venepuncture.
- If using conventional disposable syringes, withdraw 5–10 ml of whole blood from adults, 2–5 ml from children and 0.5–2 ml from infants. Using aseptic technique, transfer the specimen to the appropriate cap transport tubes and culture bottles. Secure caps tightly.
- If using a vacuum system, withdraw the desired amount of blood directly into each transport tube and culture bottle.

- Remove the tourniquet. Apply pressure to site until bleeding stops, then apply dressing.
- Label the tube, including the unique patient identification number, using indelible marker pen.
- Do not recap used sharps (e.g. needle devices, scalpels or lancets). Discard directly into the sharps disposal container.
- Complete the case investigation and the laboratory request forms using the same identification number.

### ***Handling and transport***

- Blood specimen bottles and tubes should be transported upright and secured in a screw-cap container or in a rack in a transport box. They should have enough absorbent paper around them to soak up all the liquid in case of spill.
- For serum samples (e.g. measles), the blood cells must be separated from serum. Let the clot retract for 30 minutes, then centrifuge at 2000 rpm for 10–20 minutes and pour off the serum. If no centrifuge is available, place the sample in a refrigerator overnight (at least 4–6 hours) and pour off the serum for transport in a clean glass tube.
- Do not separate blood from serum in cases of suspected viral haemorrhagic fever unless you are a clinician or laboratory technician experienced in management of the disease. Full protection and infection control measures must be taken.
- If the specimen will reach the laboratory within 24 hours, most pathogens can be recovered from blood cultures transported at ambient temperature. Keep at 4–8 °C for longer transit periods, unless the bacterial pathogen is cold-sensitive.

## **B. Faecal specimen collection**

Stool specimens are most useful for microbiological diagnosis if collected soon after onset of diarrhoea (for bacteria < 4 days), and preferably before the initiation of antibiotic therapy. If required, two or three specimens can be collected on separate days. Stool is the preferred culture specimen for cholera or shigellosis.

### ***Materials for collection***

- Tubes with Cary–Blair transport medium
- Clean, dry, leak-proof, screw-cap container and tape if Cary–Blair transport medium is not available.
- Appropriate bacterial transport media for transport of rectal swabs from infants (ideally Cary–Blair).
- Parasitology transport pack: 10% formalin, polyvinyl isopropyl alcohol.

Note: Rapid diagnostic tests (RDTs) are available for cholera and shiga-toxin-producing *E. coli* and *Shigella*.

### ***Method of collecting a stool specimen***

If Cary–Blair transport medium is available:

- place sterile swab in freshly passed stool to allow it soak up stool;
- place swab in the Cary–Blair transport medium inside the tube;
- break off the top part of the stick without touching the tube and tighten the screw cap firmly;
- label the specimen tube.

If Cary–Blair transport medium is not available, collect freshly passed stool: 5 ml liquid or 5 g solid (pea-size – in a container. Label the container.

If RDTs are available, follow the manufacturer’s instructions; in general, each kit contains a buffer solution in which the fresh stool is suspended immediately before testing.

### ***Method of collecting a rectal swab from infants***

To collect a rectal swab from an infant:

- moisten a swab in sterile saline;
- insert the swab tip just past the anal sphincter and rotate gently;
- withdraw the swab and examine to ensure that the cotton tip is stained with faeces;
- place the swab in a sterile tube or container containing the appropriate transport medium, unless RDTs are available (in which case, follow the manufacturer’s instructions);
- break off the top part of the stick without touching the tube and tighten the screw cap firmly;
- label the specimen tube.

### ***Handling and transport***

Stool specimens should be transported in a cold box at 4–8 °C. Bacterial yields may fall significantly if specimens are not processed within 1–2 days of collection. *Shigella* is particularly sensitive to elevated temperatures. If transport medium is not available, do not allow specimen to dry: add a few drops of 0.85% sodium chloride solution.

## **C. Cerebrospinal fluid specimen collection**

The specimen of cerebrospinal fluid (CSF) must be taken by a physician or a person experienced in the procedure. CSF is used in the diagnosis of bacterial meningitis and encephalitis.

### ***Materials for collection***

A lumbar puncture tray should be used that includes:

- sterile materials: gloves, cotton wool, towels or drapes;
- local anaesthetic, needle and syringe;
- skin disinfectant: 10% povidone iodine or 70% isopropanol;
- two lumbar puncture needles: small bore with stylet;
- six small sterile screw-cap tubes and tube rack;
- water manometer (optional);
- microscope slides and slide boxes.

### ***Method of collection***

Only experienced personnel should be involved in the collection of CSF samples; hence, the method is not described here. CSF is collected directly into the separate screw-cap tubes. If the sample is not to be promptly transported, separate samples should be collected for bacterial and viral processing.

### ***Handling and transport***

In general, specimens should be delivered to the laboratory and processed as soon as possible.

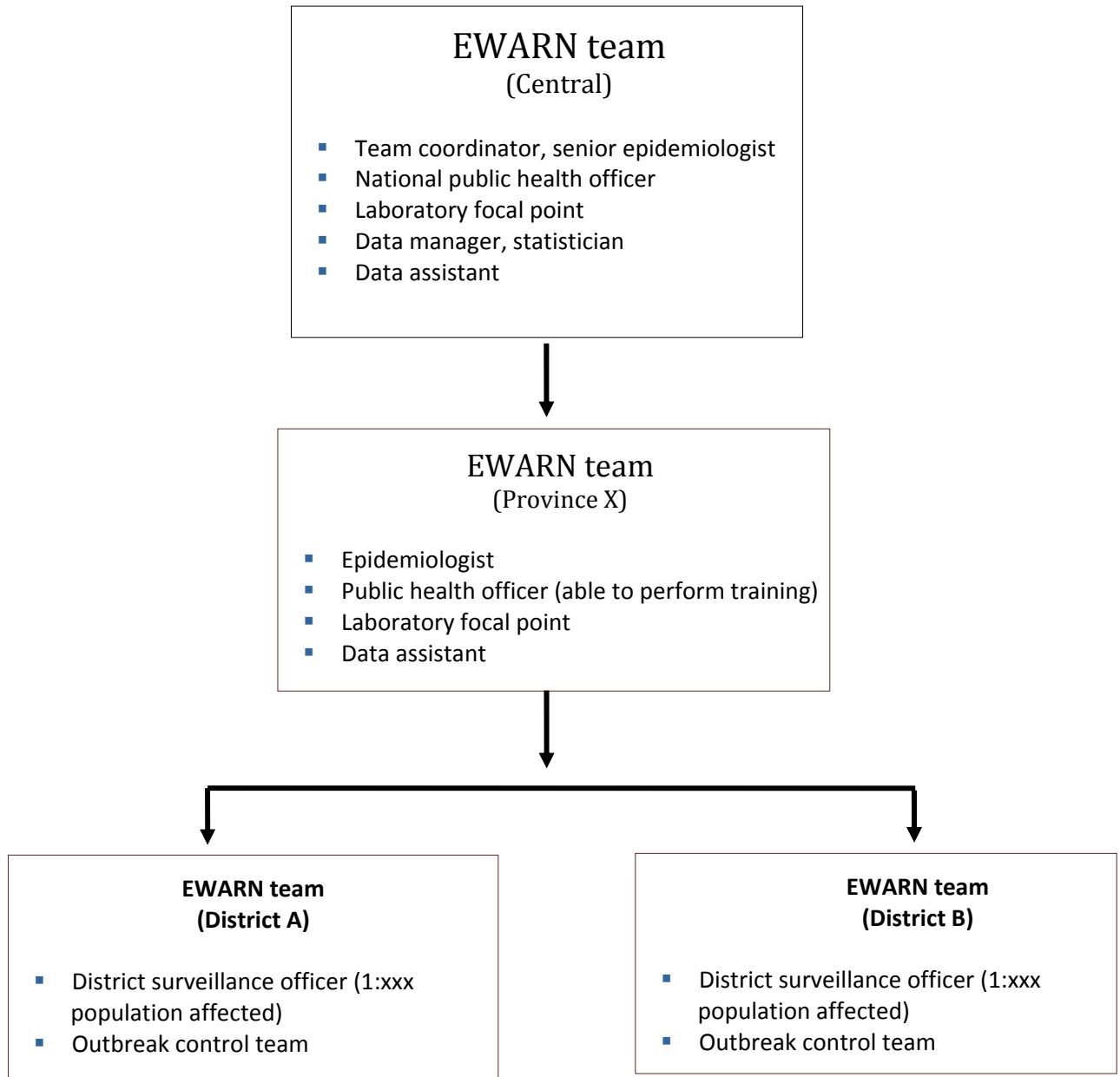
CSF specimens for bacteriology are transported at ambient temperature, generally without transport medium. They must never be refrigerated, because the relevant pathogens do not survive well at low temperatures.

### ***Rapid diagnostic tests***

Several commercial kits are available, based on the direct detection of *N. meningitidis* antigens in CSF by latex agglutination tests. Follow the manufacturer's instructions precisely when using these tests. For best results, test the supernatant of the centrifuged CSF sample as soon as possible. If immediate testing is not possible, the sample can be refrigerated (at 2– 8 °C) for up to several hours, or frozen at –20 °C for longer periods (note: latex suspensions should never be frozen). Reagents should be kept at 2– 8 °C when not in use. Product deterioration occurs at higher temperatures, especially in tropical climates, and test results may become unreliable before the expiry date of the kit. Also, some kits have a working temperature range, and tropical temperatures may be above the recommended upper limit.

## Appendix 11

### Minimum personnel requirement for EWARN



## Appendix 12

### Roles and responsibilities in EWARN

#### Central level EWARN coordinator

- Budget needs for EWARN implementation and mobilize resources; revise the surveillance system to further define its extent or priority in case of lack of resources (e.g. financial, human and transport); plan for at least 3 months functioning initially.
- Maintain regular contact with provincial and district EWARN focal points, NGO health coordinators and partners involved in public health interventions; build working relationships, share ideas and common disease control goals; and transfer knowledge and skills (to EWARN focal points in particular).
- Visit the field regularly to support and provide on-the-job training to provincial EWARN focal points when knowledge gaps are identified and to reinforce understanding of key EWARN principles and activities; learn from practical experience of EWARN focal points in the field; assess progress of public health interventions and status of epidemic-prone disease risk factors among the affected population.
- Work with provincial EWARN focal points to identify solutions to problems unique to particular health facilities, districts, or provinces under their care.
- Support provinces and districts in verification of alerts, outbreak detection, investigation and response, laboratory sample collection and testing, and timely feedback of results.
- Oversee the analysis of EWARN data, prepare situation reports, and disseminate and give feedback at relevant meetings (e.g. health cluster, WASH cluster and national epidemiologic surveillance meetings).

#### Provincial level EWARN focal point

- Monitor alert hotline and maintain a provincial alert log.
- Ensure timely verification of alerts by district focal points; provide support to the districts in outbreak detection, investigation and response.
- Ensure timely submission of weekly reports by all districts.
- Aggregate, summarize and submit reports to central coordination level.
- Conduct regular and supportive supervision and monitoring of district EWARN focal points and health facilities or reporting sites.
- Monitor anomalies in alert notification and weekly reporting, such as unreported alerts and unreported priority diseases in weekly reports.
- Perform basic analysis of provincial data to share with provincial health authorities and health partners.

#### District-level EWARN focal point

- Monitor alert hotline and maintain district alert log.
- Verify all alerts reported in the district.
- Conduct outbreak investigation with support from provincial and central level, whenever required.

- Ensure timely submission of weekly reports by all health facilities.
- Aggregate data, summarize and submit reports to the province.
- Conduct and document regular supervisory and monitoring visits of health facilities or reporting sites using the supervisory checklist (see Appendix 14).
- Conduct on-site training of new health-care staff at reporting units in EWARN function and activities.
- Monitor anomalies in alert notification and weekly reporting, such as unreported alerts and priority diseases in OPD registers.
- Ensure that health facilities have reporting forms, a list of priority diseases, and access to, and proper use of, standardized case definitions and alert thresholds.
- Ensure that alert hotlines are displayed in OPD, wards, and doctors' and nurses' offices.
- Perform basic analysis of district data to share with local health authorities, reporting units and health partners in the district.

### **Reporting unit (mobile clinic, health post, health centre, hospital)**

- Maintain a daily registry of patients seen, including information on age, sex, place of residence, outcome and specimens collected or sent to laboratory.
- Immediately notify alerts to surveillance officer, including rumours of outbreaks in the community.
- Maintain an alert log of notified alerts (date, to whom notified, results or outcomes, and follow-up action).
- In case of an outbreak, create a line list of cases and report daily to the district level.
- Perform preliminary assessment of alerts or suspected disease outbreaks and coordinate with EWARN focal point field investigations – especially through the community health worker attached to the health facility – and transmit the results of the investigation immediately to reference authorities.
- Compile EWARN priority diseases data in weekly reporting form.
- Train new health-care staff in EWARN function and activities, and ask for assistance with the EWARN focal point, if needed.

## Appendix 13

### EWARN communication resources checklist

Communication resources
<p><b>a) Communication methods:</b></p> <ul style="list-style-type: none"><li>▪ alert hotlines</li><li>▪ EWARN e-mail address</li><li>▪ EWARN fax number</li><li>▪ mail group (e.g. Google group) with e-mails of all stakeholders</li><li>▪ venue for face-to-face weekly epidemiological updates, or health or WASH cluster meetings (bi-weekly in the immediate aftermath of a disaster).</li></ul> <p><b>b) Communication hardware:</b></p> <ul style="list-style-type: none"><li>▪ mobile phones</li><li>▪ VHF (very high frequency) radio</li><li>▪ satellite phone</li><li>▪ fax</li><li>▪ Internet</li><li>▪ e-mail</li><li>▪ laptop or personal computer.</li></ul>

WASH: water, sanitation and hygiene



## Appendix 14

### Reporting unit supervisory checklist

Province .....	District .....
Health facility name .....	Name of EWARN focal point .....
Date of current supervision visit .....	Date of last supervision visit ..... <sup>a</sup>
<b>Tools</b>	
Are case definitions displayed in OPD?	Yes..... No.....
Are alert thresholds displayed in OPD?	Yes..... No.....
Is the standard outpatient register available and being used in OPD?	Yes..... No.....
Are standard reporting forms available?	Yes..... No.....
If NO, which forms are out of stock?	
If RDTs are used, are they:	
i.. stored correctly?	Yes..... No.....
ii. within expiration date?	Yes..... No.....
Are Alert Hotline(s) and names of contact persons displayed in OPD and staff office?	Yes..... No.....
<b>Performance</b>	
Number of alerts entered into the register, over the past 2 weeks, that were NOT reported immediately	.....
Over the past month, were any community rumours reported?	Yes..... No.....
Number of priority diseases entered into the register, over the past 2 weeks, that were NOT included in the weekly reporting form	.....
If reporting from the facility has been delayed, what reasons have been given for the delays?	..... .....
Are facility staff able to explain the difference between watery diarrhoea and suspected cholera?	Yes..... No.....
Do the facility staff know the number of measles cases needed for a measles alert?	Yes..... No.....
<b>Supportive supervision</b>	
Have reporting forms been supplied during this visit?	Yes..... No.....
Have weekly reporting forms, that are due this week, been collected during this visit?	Yes..... No.....
What other gaps have been identified and addressed during this visit?	..... .....
<b>Training</b>	
Was on-the-job training provided to health staff during this visit?	Yes..... No.....
If YES, list topics covered by the training	..... .....

a. Each health facility in the district must receive a supervision visit at least once per month and ideally once every 2 weeks.

## Appendix 15

### Evaluating public health surveillance systems

Evaluation of public health surveillance systems aims to ensure that problems are identified and addressed. It is important for ensuring data standards and that data exchange is occurring, to facilitate the response of public health systems to emerging health threats. The information given below has been adapted from CDC guidelines on evaluating surveillance systems<sup>1</sup>.

The activities include gathering credible evidence about the system's performance. The evaluation should:

- indicate the level of usefulness by describing the actions taken in response to analysis and interpretation of the data from the public health surveillance system;
- characterize the implementing partners that have used the data to make decisions and take actions;
- describe each of the following system attributes:
  - ***Simplicity***  
Does the system's structure and ease of operation meet the objectives? Create a chart describing the flow of data and the lines of response.
  - ***Flexibility***  
Can the system adapt to changing information needs or operating conditions with little additional time, personnel or allocated funds?
  - ***Data quality***  
Are data complete and valid? Examining the percentage of "unknown" or "blank" responses to items on surveillance forms provides a straightforward measure of data quality.
  - ***Acceptability***  
Are staff and NGOs willing to participate in the surveillance system?
  - ***Sensitivity***  
At the level of case reporting, what proportion of cases of a disease is detected by the surveillance system. At the system level, can the system detect outbreaks, including monitoring changes in the number of cases over time?
  - ***Predictive value positive***  
What is the proportion of reported cases that actually have a disease of outbreak potential?
  - ***Representativeness***  
Is the system describing the outbreak over time and its distribution in the population by place and person?
  - ***Timeliness***  
How fast is the transfer of information between steps in the alert and surveillance system? Does it meet the decision-making timeline demands for the emergency?
  - ***Stability***  
Is the system reliable (i.e. can it collect, manage and provide data properly without failure) and available (can it be operational when it is needed)?

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<sup>1</sup> For more detailed information, see: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5013a1.htm>

## Appendix 16

### Resources

#### WHO Headquarters

WHO

<http://www.who.int/fr/index.html>

<http://www.who.int/en>

Disease control in humanitarian emergencies (DCE), WHO/HQ

[http://www.who.int/diseasecontrol\\_emergencies/en](http://www.who.int/diseasecontrol_emergencies/en)

Health action in crises (HAC), WHO/HQ

<http://www.who.int/hac/en>

#### Child health in emergencies

Emergencies

[http://www.who.int/child\\_adolescent\\_health/documents/emergencies/en/index.html](http://www.who.int/child_adolescent_health/documents/emergencies/en/index.html)

Integrated management of childhood illness (IMCI)

[http://www.who.int/child\\_adolescent\\_health/documents/imci/en/index.html](http://www.who.int/child_adolescent_health/documents/imci/en/index.html)

Acute respiratory infections in children

[http://www.who.int/fch/depts/cah/resp\\_infections/en](http://www.who.int/fch/depts/cah/resp_infections/en)

*Pocket book for hospital care of children*. World Health Organization, 2005

[http://www.who.int/child\\_adolescent\\_health/documents/9241546700/en/index.html](http://www.who.int/child_adolescent_health/documents/9241546700/en/index.html)

#### Dengue

*Dengue guidelines for diagnosis, treatment, prevention and control*. WHO, 2009

[http://whqlibdoc.who.int/publications/2009/9789241547871\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241547871_eng.pdf)

Health topics: Dengue, WHO

<http://www.who.int/topics/dengue/en>

*Guidelines for dengue surveillance and mosquito control*, 2nd ed. WHO Regional Office for Western Pacific Region, 2003

[http://www.wpro.who.int/publications/pub\\_9290610689.htm](http://www.wpro.who.int/publications/pub_9290610689.htm)

*Update on the principles and use of rapid tests in dengue*. WHO Regional Office for Western Pacific Region, 2009

[http://www.wpro.who.int/internet/resources.ashx/MVP/Update+on+dengue+rapid+tests\\_15.04.09\\_final.pdf](http://www.wpro.who.int/internet/resources.ashx/MVP/Update+on+dengue+rapid+tests_15.04.09_final.pdf)

*Guidelines for treatment of dengue fever and dengue haemorrhagic fever in small hospitals*. New Delhi, World Health Organization Regional Office for South-East Asia, 1999

[http://www.searo.who.int/LinkFiles/Dengue\\_Guideline-dengue.pdf](http://www.searo.who.int/LinkFiles/Dengue_Guideline-dengue.pdf)

#### Diarrhoeal diseases

Key documents and position papers

<http://www.who.int/cholera/publications/en>

#### Drug and medical equipment donations

*Guidelines for drug donations*, WHO, revised 1999

[http://whqlibdoc.who.int/hq/1999/WHO\\_EDM\\_PAR\\_99.4.pdf](http://whqlibdoc.who.int/hq/1999/WHO_EDM_PAR_99.4.pdf) [English]

<http://apps.who.int/medicinedocs/pdf/whozip53f/whozip53f.pdf> [French]

*Guidelines for health care equipment donations*, WHO, 2000

[http://www.who.int/hac/techguidance/pht/1\\_equipment%20donationbuletin82WHO.pdf](http://www.who.int/hac/techguidance/pht/1_equipment%20donationbuletin82WHO.pdf)

## **Environmental health in emergencies**

[http://www.who.int/water\\_sanitation\\_health/hygiene/emergencies/en](http://www.who.int/water_sanitation_health/hygiene/emergencies/en)

## **Food safety**

Ensuring food safety in the aftermath of natural disasters

[http://www.who.int/foodsafety/foodborne\\_disease/emergency/en](http://www.who.int/foodsafety/foodborne_disease/emergency/en)

*Foodborne disease outbreaks – Guidelines for investigation and control*, WHO, 2008

[http://www.who.int/foodsafety/publications/foodborne\\_disease/fdbmanual/en](http://www.who.int/foodsafety/publications/foodborne_disease/fdbmanual/en)

5 Keys to safer food: simple advice to consumers and food handlers

<http://www.who.int/foodsafety/consumer/5keys/en/index.html> [English]

[http://www.who.int/foodsafety/publications/consumer/en/5keys\\_fr.pdf](http://www.who.int/foodsafety/publications/consumer/en/5keys_fr.pdf) [French]

Guidelines for the safe preparation, storage and handling of powdered infant formula, WHO, 2007

<http://www.who.int/foodsafety/publications/micro/pif2007/en/index.html> [English]

[http://www.who.int/foodsafety/publications/micro/pif\\_guidelines\\_fr.pdf](http://www.who.int/foodsafety/publications/micro/pif_guidelines_fr.pdf) [French]

## **Hepatitis**

Hepatitis A

<http://www.who.int/csr/disease/hepatitis/whocdscsredc2007/en>

Hepatitis E

<http://www.who.int/csr/disease/hepatitis/whocdscsredc200112/en>

<http://www.who.int/mediacentre/factsheets/fs280/en>

## **HIV/AIDS**

*Guidelines for addressing HIV in humanitarian settings*, Inter-Agency Standing Committee (IASC), 2009

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## **Infection prevention and control in health care**

*WHO Aide- memoire – Standard infection control precautions in health care*, WHO, 2007

<http://www.who.int/csr/resources/publications/standardprecautions/en/index.html>

*Infection prevention and control in health care for confirmed or suspected cases of pandemic (H1N1) 2009 and influenza-like illnesses*, WHO, 2009

<http://www.who.int/csr/resources/publications/swineflu/swineinflcont/en/index.html>

WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households, 2009

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*Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care*, who interim guidelines, 2007

[http://www.who.int/csr/resources/publications/swineflu/WHO\\_CD\\_EPR\\_2007\\_6/en/index.html](http://www.who.int/csr/resources/publications/swineflu/WHO_CD_EPR_2007_6/en/index.html)

## **Injection safety (see also patient safety below)**

[http://www.who.int/injection\\_safety/en](http://www.who.int/injection_safety/en)

[http://www.who.int/injection\\_safety/Guiding\\_Principals\\_FR.pdf](http://www.who.int/injection_safety/Guiding_Principals_FR.pdf)

[http://www.who.int/injection\\_safety/WHOGuidPrinciplesInjEquipFinal.pdf](http://www.who.int/injection_safety/WHOGuidPrinciplesInjEquipFinal.pdf)

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*Guidelines for the collection of clinical specimens during field investigation of outbreaks*, WHO, 2000

[http://www.who.int/csr/resources/publications/surveillance/WHO\\_CDS\\_CSR\\_EDC\\_2000\\_4/en](http://www.who.int/csr/resources/publications/surveillance/WHO_CDS_CSR_EDC_2000_4/en)

## **Leptospirosis**

[http://www.who.int/water\\_sanitation\\_health/diseases/leptospirosis/en](http://www.who.int/water_sanitation_health/diseases/leptospirosis/en)

## **Lymphatic filariasis**

<http://www.who.int/mediacentre/factsheets/fs102/en>

## **Malaria**

<http://www.who.int/malaria/en>

*Guidelines for the treatment of malaria*, 2<sup>nd</sup> ed., WHO, 2006

<http://www.who.int/malaria/docs/TreatmentGuidelines2006.pdf>

*Malaria control in complex emergencies – An inter-agency field handbook*, WHO, 2005

<http://www.who.int/malaria/publications/atoz/924159389X/en/index.html>

## **Malnutrition**

*Communicable diseases and severe food shortage situations*, WHO, 2005

[http://www.who.int/malaria/publications/atoz/cds\\_severe\\_food\\_shortages/en/index.html](http://www.who.int/malaria/publications/atoz/cds_severe_food_shortages/en/index.html)

*The management of nutrition in major emergencies*, WHO, 2000

<http://www.who.int/nutrition/publications/emergencies/en/index.html>

*Infant and young child feeding in emergencies – Operational guidance for emergency relief staff and programme managers*, Version 2.0, Infant and Young Child Feeding in Emergencies (IFE) Core Group, 2006 <http://helid.digicollection.org/en/d/Js13437e>

Nutrition in emergencies publications

<http://www.who.int/nutrition/publications/emergencies/en/index.html>

## **Management of dead bodies**

*Management of dead bodies after disasters – A field manual for first responders*, PAHO, 2006

<http://www.paho.org/english/dd/ped/DeadBodiesFieldManual.pdf>

*Management of dead bodies in disaster situations*, PAHO, 2004

<http://www.paho.org/english/DD/PED/DeadBodiesBook.pdf>

## **Measles**

*Reducing measles mortality in emergencies*, WHO/ UNICEF, 2004

[http://www.unicef.org/publications/index\\_19531.html](http://www.unicef.org/publications/index_19531.html)

Measles vaccines – WHO position paper. *Weekly epidemiological record* 79(14):129–144

[http://www.who.int/immunization/wer7914measles\\_April2004\\_position\\_paper.pdf](http://www.who.int/immunization/wer7914measles_April2004_position_paper.pdf)

*Response to measles outbreaks in measles mortality reduction settings* (This publication replaces *WHO guidelines for epidemic preparedness and response to measles outbreaks*, May 1999.)

[http://www.who.int/immunization/documents/WHO\\_IVB\\_09.03/en/index.html](http://www.who.int/immunization/documents/WHO_IVB_09.03/en/index.html)

<http://www.who.int/immunization/documents/date/en/index.html>

WHO measles information

<http://www.who.int/immunization/topics/measles/en/index.html>

Measles fact sheet

<http://www.who.int/mediacentre/factsheets/fs286/en>

## **Medical waste in emergencies**

[http://www.who.int/water\\_sanitation\\_health/medicalwaste/emergmedwaste/en](http://www.who.int/water_sanitation_health/medicalwaste/emergmedwaste/en)

*Guidelines for safe disposal of unwanted pharmaceuticals in and after emergencies*, WHO, 1999

<http://www.healthcarewaste.org/en/documents.html?id=15&suivant=16>

*Four steps for the sound management of health-care waste in emergencies*, WHO, 2005  
<http://www.healthcarewaste.org/en/documents.html?id=184&suivant=8>

## **Meningitis**

*Control of epidemic meningococcal disease – WHO practical guidelines*, 2nd ed., WHO, 1998  
[http://www.who.int/csr/resources/publications/meningitis/WHO\\_EM\\_C\\_BAC\\_98\\_3\\_EN](http://www.who.int/csr/resources/publications/meningitis/WHO_EM_C_BAC_98_3_EN)

<http://www.who.int/csr/resources/publications/meningitis/whoemcbac983f.pdf>

## **Patient safety (see also Injection safety above)**

<http://www.who.int/patientsafety/en>

## **Polio**

WHO-recommended surveillance standard of poliomyelitis  
[http://www.who.int/immunization\\_monitoring/diseases/poliomyelitis\\_surveillance/en/index.html](http://www.who.int/immunization_monitoring/diseases/poliomyelitis_surveillance/en/index.html)

## **Rabies**

Rabies. Guide for post-exposure prophylaxis  
<http://www.who.int/rabies/human/postexp/en>

WHO rabies page  
<http://www.who.int/topics/rabies/en>

## **Risk assessment**

Protocol for humanitarian emergencies – Communicable disease risk assessment.  
[http://www.who.int/diseasecontrol\\_emergencies/publications/who\\_cds\\_ntd\\_dce\\_2007.4/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/who_cds_ntd_dce_2007.4/en/index.html)

## **Risk communication**

*Information management and communication in emergencies and disasters – Manual for Disaster Response Teams*, PAHO, 2009  
[http://new.paho.org/disasters/index.php?option=com\\_content&task=view&id=997&Itemid=1](http://new.paho.org/disasters/index.php?option=com_content&task=view&id=997&Itemid=1)

*WHO outbreak communication planning guide*, WHO, 2008  
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*WHO outbreak communication guidelines*, WHO, 2005  
<http://www.who.int/infectious-disease-news/IDdocs/whocds200528/whocds200528en.pdf>

## **Specific messages**

Hand hygiene  
[http://www.who.int/gpsc/5may/How\\_To\\_HandWash\\_Poster.pdf](http://www.who.int/gpsc/5may/How_To_HandWash_Poster.pdf)

Food safety  
<http://www.who.int/foodsafety/publications/consumer/5keys/en/index.html>

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<http://www.who.int/features/qa/31/en>

## **Tetanus**

*Current recommendations for treatment of tetanus during humanitarian emergencies – WHO technical note*, WHO, 2010  
[http://www.who.int/diseasecontrol\\_emergencies/publications/who\\_hse\\_gar\\_dce\\_2010.2/en/index.html](http://www.who.int/diseasecontrol_emergencies/publications/who_hse_gar_dce_2010.2/en/index.html)

*Immunological basis of immunization – Module 3: tetanus* (update 2006). WHO, 2007  
<http://www.who.int/immunization/documents/ISBN9789241595551/en/index.html>

WHO position paper on tetanus immunization  
Tetanus vaccine. WHO position paper. *Weekly Epidemiological Record* 81 (20): 197–208  
[http://www.who.int/immunization/wer8120tetanus\\_May06\\_position\\_paper.pdf](http://www.who.int/immunization/wer8120tetanus_May06_position_paper.pdf)

## **Travel advice**

Guide on safe food for travellers  
<http://www.who.int/foodsafety/publications/consumer/travellers/en/index.html>

*International travel and health 2011*, WHO, 2011  
<http://www.who.int/ith/en>

## **Tuberculosis**

*Tuberculosis care and control in refugee and displaced populations – An interagency field manual*, 2<sup>nd</sup> ed., WHO/UNHCR, 2007  
[http://whqlibdoc.who.int/publications/2007/9789241595421\\_eng.pdf](http://whqlibdoc.who.int/publications/2007/9789241595421_eng.pdf)

## **Vector control**

Integrated vector management  
[http://www.who.int/malaria/vector\\_control/ivm/en/index.html](http://www.who.int/malaria/vector_control/ivm/en/index.html)

Malaria vector control  
<http://www.who.int/malaria/vectorcontrol.html>

*Pesticides and their application – For the control of vectors and pests of public health importance*, 6<sup>th</sup> ed., World Health Organization, 2006  
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## **Water and sanitation**

*Guidelines for drinking-water quality – Incorporating first and second addenda*, 3rd ed., WHO, 2008  
[http://www.who.int/water\\_sanitation\\_health/dwq/gdwq3rev/en/index.html](http://www.who.int/water_sanitation_health/dwq/gdwq3rev/en/index.html)

*Environmental health in emergencies and disasters: a practical guide*, WHO, 2003  
[http://www.who.int/water\\_sanitation\\_health/emergencies/emergencies2002/en/index.html](http://www.who.int/water_sanitation_health/emergencies/emergencies2002/en/index.html)

WHO technical notes on drinking water, sanitation and hygiene in emergencies  
[http://www.who.int/water\\_sanitation\\_health/hygiene/envsan/technotes/en/index.html](http://www.who.int/water_sanitation_health/hygiene/envsan/technotes/en/index.html)

Frequently asked questions in case of emergencies  
[http://www.who.int/water\\_sanitation\\_health/emergencies/qa/en/index.html](http://www.who.int/water_sanitation_health/emergencies/qa/en/index.html)

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## **Wounds and injuries (see also tetanus above)**

Prevention and management of wound infection – Guidance from WHO's Department of Violence and Injury Prevention and Disability and the Department of Essential Health Technologies  
[http://www.who.int/hac/techguidance/tools/guidelines\\_prevention\\_and\\_management\\_wound\\_infection.pdf](http://www.who.int/hac/techguidance/tools/guidelines_prevention_and_management_wound_infection.pdf)

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<http://www.who.int/surgery/publications/imeesc/en/index.html>

*Best practice guidelines on emergency surgical care in disaster situations*, WHO, 2005  
<http://www.who.int/surgery/publications/BestPracticeGuidelinesonESCinDisasters.pdf>

*WHO generic essential emergency equipment list*, WHO, 2003  
<http://www.who.int/surgery/publications/EEEGenericListFormatted%2006.pdf>

## **Zoonotic diseases**

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