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Aalisha Sahu Khan Date

Priority Diseases for Early Warning Alert and Response Networks (EWARN) 1997-2016

By

Aalisha Sahu Khan
MPH

Hubert Department of Global Health

Susan T. Cookson, MD, MPH
Committee Chair

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By

Aalisha Sahu Khan
MBBS
University of the South Pacific
2010

Thesis Committee Chair: Susan T. Cookson MD, MPH

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Abstract

Priority Diseases for Early Warning Alert and Response Networks (EWARN) 1997-2016

By Aalisha Sahu Khan

Background: Forcibly displaced populations experience increased mortality and morbidity. Communicable diseases, with or without malnutrition, are the major causes of illness and death when control measures are inadequate. Early warning for outbreaks of communicable disease is critical in mitigating impact on vulnerable displaced populations. Prioritising diseases for an early warning alert and response network (EWARN) surveillance system is essential to ensure minimal and necessary information is collected. The WHO 2012 EWARN Implementation Guidelines aim to increase data quality, timeliness, completeness, and in turn efficacy through standardising the process of setting up an EWARN. This study will focus on disease/syndrome prioritisation, specifically comparing disease selection for EWARN-like systems from 1997-2017 with recommendations of the WHO 2012 guidelines.

Methods: Articles listing diseases selected for EWARN-like systems from January 1997 to June 2017 were collected from PubMed/MEDLINE, ProQuest, Google Scholar, and the website and database of WHO (WHOLIS). Grey literature was included in the search. Data extracted included lists of diseases/syndromes included in each surveillance system.

Results: A total of 3,066 articles were identified, and 1,471 duplicates removed, leaving 1,595. After applying the exclusion criteria the final dataset included 33 articles listing diseases/syndromes for 20 EWARN-like systems in 17 countries from 1997-2016. Of the systems, 35% (n=6) were for emergencies or disasters in the Eastern Mediterranean, 20% (n=4) Africa, 20% (n=4) Western Pacific, 15% (n=3) Europe, 10% (n=2) South East Asia, and 5% (n=1) in the Americas. Overall, 25% (n=5) of systems were set up after 2012, and 75% (n=15) of systems were established from 1997-2012. Pakistan (2005) and Somalia (2013) included all 8 WHO recommended diseases/syndromes. Most frequently left out of the systems were acute flaccid paralysis (40%) and acute haemorrhagic fever (30%). All 20 systems (100%) included acute watery diarrhoea (suspected cholera), acute bloody diarrhoea (suspected shigellosis), and suspected measles.

Conclusion: The omission of acute flaccid paralysis, particularly from systems established after 2012, was unexpected. This emphasizes the need to understand the context of an emergency (e.g., endemic disease, complementary surveillance systems) while also carefully evaluating any potential health system breakdown increasing risk of previously eradicated disease, e.g. lack of vaccination against polio virus.

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Research Question:

How do selected diseases in the EWARN-like systems established from 1997 - 2017, compare with recommendations of the WHO 2012 EWARN Implementation Guidelines.

Introduction

The number of people forcibly displaced from their homes increases every year, with the United Nations High Commissioner for Refugees (UNHCR) reporting numbers in excess of 40 million since 2007(UNHCR, 2011). In 2015 the UNHCR's annual Global Trends report stated that: even though the rate of increase had slowed compared to sharp increases in previous years, the number of displaced persons worldwide was at its highest since the end of World War II; with 65.3 million being forced from their homes; and of these 12.4 million were newly displaced (UNHCR, 2015).

The Internal Displacement Monitoring Centre is an international non-governmental organisation monitoring worldwide internal displacement of populations established in 1998 by the Norwegian Refugee Council (IDMC,2017).The term 'Internally Displaced Persons' (IDPs) refers to those who have been forcibly displaced from their homes but have not crossed international borders; unlike refugees (UNHCR, 2017).

The IDMC's annual Global Report on Internal Displacement 2016 reported 40.3 million IDPs worldwide, with 31.1 million new cases that year. An increase of 3.3 million from 2015 (IDMC, 2017). Of these, 21.6 million people were displaced by disasters, and 6.9 million by conflict.

Regardless of the status of displaced people as IDPs or refugees, displacements of large populations are associated with an increase in mortality and morbidity (American Public Health Association, 1992). Communicable diseases have a significant impact on the health of displaced persons, in part due to the conditions of displacement, i.e., lack of access to sanitation and clean water facilities, and overcrowding in emergency shelters. Furthermore, disasters may also damage infrastructure, further limiting access to essential facilities and exacerbating the risk of infectious disease outbreaks.

Therefore, international agencies like the World Health Organisation (WHO), Centers for Disease Control and Prevention (ECDC European Center for Disease Prevention and Control), and Médecins Sans Frontières (MSF) prioritise communicable disease control in emergency settings. This is highlighted in MSF 1997 Refugee Health guideline, where six of the ten top intervention priorities of in the emergency phase of a disaster or emergency are directly related to preventing communicable diseases (Figure 1).

Figure 1: Médecins Sans Frontières intervention priorities in the emergency phase of emergency situation

(Medecins Sans Frontieres, 1997) pp.38

Surveillance of communicable diseases was also recognized as an important mitigating measure in controlling outbreaks. However, there lacked a widely accepted standard protocol/guideline for implementing communicable disease surveillance in emergencies. The need for such a guideline became clear in the 1990s with an international move to secure global health security.

During this period, member states of the WHO called for a response to resurgence of large communicable disease epidemics worldwide e.g. cholera in Zaire (Goma Epidemiology, 1995). This resulted in resolution WHA48.7 at the World Health Assembly 1995, calling for revision of the International Health Regulations(WHO, 2017). The IHR (1969) had been intended to monitor and control cholera, plague, yellow fever, small pox, relapsing fever, and typhus.

Therefore its focus was limited, did not cover emerging diseases, with effectiveness hampered by a lack of international coordination mechanisms related to reporting and prevention of disease spread (World Health Organisation, 2009b). Recognizing the potential impacts of outbreaks on global health security, the World Health Assembly in 2001 adopted resolution WHA54.14 calling on WHO to support member states in the strengthening capacity to detect and respond rapidly to communicable disease threats and emergencies. The World Health Assembly adopted IHR (2005) on May 2005, which formally came into force in 2007. Under the IHR (2005) member states are required to develop, strengthen and maintain core public health capacities for surveillance and response and notify WHO of all events that may constitute a public health event of international concern (World Health Organisation, 2009b).

As part of fulfilling the mandate to strengthen core capacities of member states, in 2005 the WHO published a field manual for communicable disease control in emergencies, which included guidance on setting up an early warning surveillance network/system (EWARN) in an emergency (World Health Organisation, 2005a) . Development of EWARN would continue, with the input of numerous international agencies experienced in humanitarian response; culminating in the publication of the 2012 WHO Guidelines for EWARN Implementation (details discussed from pp.14).

Statement of Problem

With the development of the 2012 WHO Guidelines for EWARN Implementation, the World Health Organisation (WHO) and partners embarked on an effort to standardize early warning communicable disease surveillance in emergencies and disasters. The guideline highlights minimal data requirements as key means to improve surveillance data quality. This includes focusing resources on epidemic prone disease, with recommendations for disease prioritisation in EWARN. The guidelines were crafted through extensive consultations with international agencies, and consensus among recognized experts in the field. And yet there has been no assessment published of disease prioritisation in pre and post 2012 EWARN-like systems. Such a scoping assessment is necessary to determine the effect of the guidelines on disease selection and prioritisation in EWARN.

Statement of Purpose

This work will examine priority disease selection for EWARN-like systems from 1997 to 2017, and compare the findings to recommendations of the 2012 WHO Guidelines for EWARN Implementation.

Literature Review

Epidemiology of communicable disease among populations displaced by emergencies or disasters

According to the International Federation of Red Cross and Red Crescent Societies (IFRC,2017) a disaster is a "sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origins."(IFRC, 2017) Often the event may be sudden, but relatively slow moving events may also be considered as disasters e.g. drought, famine, and climate change.

Complex emergencies/complex humanitarian emergencies (referred to from here as 'emergency'), as defined by the WHO, combine internal conflict with large-scale displacements of people, mass famine or food shortage, and fragile or failing economic, political, and social institutions (WHO, 2017a).This may be exacerbated by disasters, and a key issue being that response and recovery mechanisms that are in place following disasters without internal conflict are absent or diminished thereby amplifying the effects of an emergency or disaster.

Emergencies and disasters often result in the displacement of populations, which has been associated with increased morbidity and mortality (American Public Health Association, 1992). When considering the causes of this, it is helpful to consider three major factors: the baseline health issues of the general population in the affected country/area, the immediate history of the displaced population, and the environmental conditions of the affected area (including temporary camps/shelter) (Paquet, 1998).

Firstly, a low-income country with poor health indicators would be more at risk for high morbidity and mortality following an emergency or disaster due to a general lack of resources and infrastructure, specifically related to access to clean water, and sanitation, as well as lack of health care resources for response including early warning for outbreaks. Also, the health of the displaced population prior to displacement is important. For example, those living in extreme poverty or in prolonged conflict areas may have increased prevalence of malnutrition and/or low vaccination rates, resulting in weakened immunity. Thereby increasing the risk of infection.

Finally, these populations are frequently resettled in temporary shelters, which (at least initially) may have poor environmental conditions, which foster communicable disease transmission. These include lack of appropriate shelter, and overcrowding. There may also be food insecurity, unsafe water, and poor sanitation facilities. These conditions increase the risk of communicable diseases, particularly outbreak prone diseases. Should these poor conditions continue, deaths caused by communicable diseases often surpass those directly caused by

the initial disaster or emergency. According to Connolly (2004), in most complex emergencies communicable diseases or communicable diseases with malnutrition are the major causes of morbidity and mortality. And the major diseases causing death and illness are: diarrhoeal diseases, including cholera and dysentery, acute respiratory infection, measles, and malaria (Connolly, 2004)

Paquet (1998) reported that measles, diarrhoeal diseases, malaria and acute respiratory infection accounted for 50% to 95% of all recorded refugee deaths in Thailand (1979), Somalia (1980), Malawi (1987) and Zaire (1994- now the Democratic Republic of the Congo).

The Zaire refugee crisis in 1994 is an often-cited example of the catastrophic consequences of mass population displacement. An estimated 500,000- 800,000 ethnic Rwandan Hutus, fleeing the Rwandan civil war and genocide, sought refuge in and around the town of Goma in northern Zaire. During the first month after the influx, 47,500 refugees were confirmed to have died i.e. 6% -10% of the refugee population. A later survey found that 88% (41 800) of the deaths during this period were caused by diarrhoeal disease, and of these 57% were due to cholera and much of the remainder by shigella dysentery (Goma Epidemiology, 1995)

Acute respiratory infection is also a leading cause of death in emergencies and disasters due to conditions of overcrowding, poor ventilation, and inadequate shelter resulting in exposure to the environmental elements. In 2010, a systematic review of the literature (Bellos, 2010) found that acute respiratory

infection was consistently the first or second most frequent causes of outpatient consultation in displaced populations. And if second, diarrhoeal diseases were first. The same review also notes that, while the worldwide proportion of deaths attributable to acute respiratory among children under 5 year old is estimated at 17% - 23%, this proportion was higher (20-35%) in most studies included in the review (Bellos, 2010).

Poor vaccination coverage is a common finding in displaced populations, which in turn increases the risk of outbreaks of vaccine preventable diseases e.g. measles. A review of measles outbreaks in displaced populations worldwide from 1982 to 2006 found that out of 8 studies of outbreaks that reported vaccination status, 7 occurred in poorly vaccinated populations (vaccine coverage: 17-57%) prior to arrival at emergency shelter/camps (Kouadio, 2010).

Along with poor vaccination coverage, measles is a top cause of morbidity and mortality in displaced populations due to overcrowding in shelters (increasing the risk of transmission), as well as poor food security causing malnutrition and subsequent impaired immunity from infection. As a low-income country that has been subject to recurrent environmental disasters (e.g. drought), conflict, and food shortages, internally displaced populations in Ethiopia highlight the synergistic relationship between the current general health of a population and environmental conditions in affecting the risk of communicable disease spread. Case in point, in 2000, from July 27 through August Salama (2001) conducted a survey to estimate mortality rates in the previous 8 months and determined the major causes of death, in the Gode district. The sample included 58.2% of

households that had been displaced. Their findings included that wasting contributed to 72.3% of all deaths among children younger than 5 years. Measles alone, or in combination with wasting, accounted for 35 (22.0%) of 159 deaths among children younger than 5 years and for 12 (16.7%) of 72 deaths among children aged 5 to 14 years (Salama, 2001).

Médecins Sans Frontières also described the coexistence of malnutrition with communicable disease in displaced populations in a 2013 mortality and nutrition survey of Somali refugees at the Dadaab refugee complex in Kenya. The surveyed population included 26,583 individuals, of whom 6,488 (24.4%) were children aged under 5 years. The findings were that two-thirds of all deaths were reported to have been associated with diarrhoea (25%), cough or other breathing difficulties (24%), fever (19%), or measles (17%) and global acute malnutrition (GAM) and severe acute malnutrition was observe in 13.4% and 3.0% of all children respectively(Polonksy et al.,2013).

Malaria is also of concern for displaced populations in endemic areas, particularly in those already made weak by disease, or malnutrition, or those at the extremities of age. In 2011, Hershey conducted a retrospective study of morbidity and mortality of children under age five years in 90 UNHCR run camps in 16 countries from January 2006- February 2010. The findings were that malaria and pneumonia were the two most common causes of mortality, with confirmed malaria and pneumonia each accounting for 20% of child deaths (Hershey, 2011). Suspected and confirmed malaria accounted for 23% of

morbidity and pneumonia accounted for 17% of morbidity. Diarrhoeal diseases were the cause of 7% of deaths and 10% of morbidity.

Together these examples of diarrhoeal disease, acute respiratory infection, measles, and malaria clearly illustrate the scale of the impact of communicable disease on populations displaced by emergency or disaster. This also highlights the critical need to employ appropriate early warning and response measures during events where populations are displaced.

Communicable Disease Surveillance in Emergencies and Disasters

The previous section described how, following emergencies or disasters, there is an increased risk of communicable disease outbreaks because of population displacement and poor basic and health services. When these events occur in low-income countries, communicable disease surveillance system may be non-existent, or existing systems may be inadequate for early warning. Also, the loss of basic infrastructure (i.e. communications, electricity, roads) and damage to health facilities may affect an existing disease surveillance system to the extent that it underperforms or is completely non functional. Coupled with strain on remaining infrastructure and human resources, the danger is that the early warning signs of a disease outbreak will be missed, and with it, the opportunity to mitigate impact, on an already vulnerable population.

Therefore, an immediate response to an emergency or disaster must be establishing an early warning surveillance and response system that will detect and respond rapidly to disease outbreaks.

To address this risk of outbreaks, the common practice has been for ministries of health or local health departments to set up an early warning alert and response system (also known as EWARN) or EWARN-like system often assisted by the WHO and its partners (World Health Organisation, 2009a). EWARN is an early warning surveillance system that works to alert health authorities to the early signs of an outbreak in order to prompt early response and mitigate its impact. The shared objective of all these systems was to detect and respond rapidly to outbreaks of epidemic-prone diseases. However, each system was different and there were no standards established to guide implementation.

Recognizing this non-uniformity, in 2012 WHO and partners, implemented guidelines for setting up an EWARN (WHO, 2012). According to the guidelines, key goal of EWARN is the collection of essential, minimal, data on selected diseases, the timely analysis of trends, and dissemination of information for response. (WHO, 2012).

Communicable Disease Prioritisation in Emergencies and Disasters

To date there has not been an article published in a peer-reviewed journal that examines disease selection, nor the methods of selection, for EWARN-like surveillance systems during emergencies or disasters.

However, a ranking of risk of specific disease outbreaks was included in a 1994 WHO Regional Publication from the Regional Office for the Eastern Mediterranean entitled 'Health Laboratory Facilities in Emergencies and Disaster Situations' (WHO, 1994). This was published to guide health laboratory services operations during emergency situations. Also covered in this guideline was the problems associated with emergencies and disasters that may affect those services e.g. loss of electricity, communications, damage to laboratories etc. The authors included a ranking table estimating the risk of a specific communicable disease becoming a problem (i.e. causing an outbreak) during a particular emergency or disaster situation, with the following classification: 0 = rare problem, 1=potential problem 2= likely problem (Appendix 1). For example, measles was ranked 2 for situations of population displacement, 1 for earthquake/volcanic eruption, and 0 for environmental pollution. This may be useful, as such ranking for communicable disease risk in emergencies or disasters had not been published previously or since, however it is a major limitation that there was no reference or information given in these guidelines to describe the methodology used to produce the ranking. Furthermore, it is clear that disease selection for surveillance systems during emergency and disaster situations was not a focus of the publication.

Outbreak surveillance and response in humanitarian emergencies, WHO guidelines for EWARN implementation 2012

The 2012 WHO guidelines on implementing EWARN (WHO, 2012) were formulated through a rigorous, evidence based process beginning at the first WHO Technical Workshop on EWARN in Emergencies, December 7-8 2009 (WHO, 2009a) where evidence was presented from:

- Existing literature
- Existing surveillance guidelines
- Desk review of EWARN in five countries (Albania, Chad, Iraq, Myanmar, and Sudan)
- Formal field evaluations in Darfur and South Sudan (using standard evaluation methodology)
- Review of EWARN experiences from organisations including Médecins Sans Frontières (MSF), UNHCR, and the International Federation of the Red Cross (International Federation of Red Cross and Red Crescent Societies (IFRC)) – based on standard methodology.

The 2009 workshop was attended by technical experts international organisations, including the WHO and the United States Centers for Disease Control and Prevention (World Health Organisation, 2012). The recommendations from the workshop included the establishment of a guidelines development group, comprised of experts from many of the organisations represented at the workshop, which would gather and review more evidence from the field through formal expert evaluations of existing EWARN systems.

Draft guidelines from the development group were then presented and reviewed at the second WHO Technical Workshop in May 2011, along with findings from expert evaluations in 2010 of EWARN systems in Haiti and Pakistan. Implementation experience of EWARN in the Philippines in 2010 was also presented and assessed(World Health Organisation, 2012). Finalization of the guidelines was achieved at the 2011 workshop through consensus, based on the best evidence available. The guideline 'Outbreak surveillance and response in humanitarian emergencies: WHO guidelines for EWARN implementation' was published in 2012.

"The primary objective of an EWARN is to rapidly detect and respond to signals that might indicate outbreaks and clusters of epidemic-prone diseases." (World Health Organisation, 2012)

The recommendations for disease selection within the WHO 2012 guidelines draw from earlier WHO guidelines that advise conducting risk assessments for disease prioritization during emergencies(WHO, 2007) (WHO, 2005a). Communicable disease risk assessment is outlined in a three-step process; event description, threat or vulnerability assessment, and risk characterization. Also included was a list of select infectious diseases linked to three conditions often associated with emergencies and disasters i.e. poor water and sanitation, overcrowding, and vector-borne disease (Appendix 2).

The WHO 2012 guidelines recommend the following diseases/syndromes for inclusion in EWARN:

- Acute flaccid paralysis (poliomyelitis)
- Acute haemorrhagic fever syndrome
- Measles (suspected)
- Suspected cholera or acute watery diarrhoea (AWD),
- Suspected shigellosis or bloody diarrhoea
- Acute jaundice syndrome
- Suspected bacterial meningitis
- Confirmed malaria

The 2012 WHO guideline recommends the following criteria be considered when prioritizing diseases for EWARN:

- Epidemic potential
- Ability to cause severe morbidity or death
- International surveillance requirements (International Health Regulations (IHR) Public Health Event of International Concern (PHEIC)
- Availability of prevention and control measures;
- Availability of reliable and meaningful case definitions and simple laboratory tests, where appropriate.

The guidelines reiterate that only epidemic prone diseases should be prioritized for surveillance as, in the past, the inclusion of diseases that were of public health importance, but not epidemic prone, had an adverse effect on data quality.

To highlight this point, the guidelines provide explanations for the inclusion or exclusion of the following diseases/syndromes:

Diarrhoeal disease

Diarrhoeal diseases are one of the main causes of morbidity and mortality due to communicable disease in emergencies and disasters (Connolly, 2004). However, the 2012 WHO guidelines state that only cholera and shigellosis should be included in EWARN, as they have the potential to cause large outbreaks, whereas other diarrhoeal diseases are not an immediate threat in terms of outbreak potential. Another issue is that while acute watery diarrhoea is the syndrome recommended by the guidelines as an early warning indicator for cholera, the term is often used to describe other forms of acute diarrhoea (WHO, 2012). It is emphasized that there must be consistent use of case definitions and terms.

Malaria

As recounted earlier, malaria causes high mortality in displaced populations, particularly in children under the age of 5 years (Hershey, 2011). However, due to the low positive predictive value of the clinical case definition for malaria (i.e. low chance the patient has malaria even if they meet the case definition), the 2012 WHO guidelines recommend its inclusion in EWARN only if confirmed by rapid diagnostic testing (RDT) or microscopy.

Acute respiratory infections

As discussed earlier, acute respiratory infections are one of the most frequent causes for outpatient consultation in displaced populations (Bellos, 2010). The

2012 WHO guidelines however state that acute respiratory infection should not be included in EWARN as: most uncomplicated cases of upper respiratory tract infection (URTI) resolve on their own, and most reporting sites will not capture high quality data on this condition. The guidelines do state however that if acute respiratory infection were to be included that it should focus on lower respiratory tract infection (LRTI), as pneumonia is a leading cause of mortality in children aged under 5 years. It would also be useful for early warning for respiratory outbreak prone disease like novel influenza (World Health Organisation, 2012)

Malnutrition

Malnutrition is a common affliction of populations displaced by emergencies or disasters and often contributes to the morbidity and mortality associated with communicable diseases. A 2011 household mortality survey conducted by Polonsky (2013) in the Dagahaley camp, Dadaab refugee camp complex, found that of the 26,583 individuals surveyed, of whom 6,488 (24.4%) were children aged under 5 years: global acute malnutrition (GAM) was observed in 13.4%, and severe acute malnutrition (SAM) in 3.0%, of children measuring 67-<110 cm i.e. children under age 5 years.[1]

However, this was a survey and not surveillance. The WHO 2012 guidelines state that malnutrition is poorly captured when included in EWARN surveillance for the following reasons:

[1] Height measurements are used as a proxy for age in populations where demographic data is not reliable. In the 2011 Polonsky et al. household survey, mid-upper arm circumference measurements were taken, and the presence or absence

- Only new cases of malnutrition at a health facility are captured, which may underestimate the actual cases in a community. This is because prevalence, more than incidence, is the main indicator for malnutrition.
- EWARN only requires one major diagnosis; therefore many cases of malnutrition may be missed as patients often present with other diseases (diarrhoea, pneumonia etc.) and these are more likely to be recorded instead.

Therefore, as was done in Polonsky (2013), the guidelines recommend that acute malnutrition is monitored through community based surveys using measurements of upper arm circumference and weight for height.

Acknowledging the consensus of the world's expert agencies in the adoption of the 2012 WHO guidelines, this review will examine EWARN-like systems established during a 20-year period from 1997-2017, specifically:

- Comparing to disease selection recommendations of the 2012 WHO guidelines.
- Assessing common findings across systems
- Discussing possible reasons for differences

Methods

Search strategy

A comprehensive search of five databases was done first by looking for articles mentioning EWARN/EWARS, early warning alert and response, then using communicable disease related keywords (infectious disease, outbreak, epidemic etc.) AND events (disasters, emergencies) OR populations (refugees, IDPs). Next, keywords for specific syndromes/diseases were selected AND events (disasters, emergencies) OR populations (refugees, internally displaced persons).

Table 1: Search terms

Communicable disease, infectious disease, outbreak, epidemic, surveillance, surveillance system, public health surveillance, epidemiology, EWARN, EWARS, DEWS, CSR, EWARS in a box, SPEED, early warning alert and response network, early warning alert and response system, early warning surveillance, measles, cholera, diarrhoea, shigellosis, respiratory infection, influenza, malaria, meningitis, typhoid fever, dengue fever, yellow fever
AND
Disaster, post disaster, emergencies, complex emergency, humanitarian emergency, conflict, war, flood, hurricane, cyclone, typhoon, tsunami, earthquake, famine, drought, refugee, refugee camp, internally displaced person, displaced person, population displacement

Also, an initial review of the literature indicated known disasters or emergencies where EWARN-like systems were used. These were included using the specific country/region matched to the common search terms (Table 2).

Table 2: Country/region specific search terms

Darfur, South Sudan, Nigeria, Solomon Islands, Fiji, Pakistan, Haiti, Somalia, Chad, Iraq, Syria, Philippines AND Communicable disease, infectious disease, outbreak, epidemic, surveillance, surveillance system, public health surveillance, epidemiology, EWARN, EWARS, early warning alert and response network, early warning alert and response system, early warning surveillance AND Disaster, post disaster, emergencies, complex emergency, humanitarian emergency, conflict, war, flood, hurricane, cyclone, typhoon, tsunami, earthquake, famine, drought, refugee, refugee camp, internally displaced person, displaced person, IDP, population displacement

MeSH (Medical Subject Headings) terms, determined according to the mentioned key search terms, were also used to search in MEDLINE.

Backward chaining (scanning relevant article reference lists of relevant articles) and forward chaining (searching Google Scholar and PubMed to locate the referenced articles) was also utilized.

Articles were checked for duplication, duplicates removed, and then screened for relevance to the research question. Articles were assessed for eligibility if found

specific to communicable diseases AND disasters and/or emergencies, AND published after the year 1997. This year was chosen considering the following: the draft text of the revised International Health Regulations was available in 1997 (with the final published in 2005) mandating national core competencies in monitoring and reporting threats to global health security WHO(1997); publication of the WHO EWARN guidelines in 2012(World Health Organisation, 2012). The eligible articles underwent full text review and were included if contained: description of the early warning surveillance system; diseases under surveillance and/or method of disease selection.

Data Sources

PubMed, ProQuest, Google Scholar, and the website and database of WHO (WHOLIS) were searched using the search terms in Box 1-2, plus MeSH terms used for searching MEDLINE. Grey literature was included in the search.

Data Organisation

Country or region specific publications were tabulated on a spread sheet where specific variables were extrapolated i.e. country, year of event, name of system, disaster/emergency type, publication, publication date, diseases selected, compliance to WHO guidelines disease number (8-12), compliance to WHO recommended diseases, disease list.

Results

Overall

The literature search using the terms described produced 3,066 articles. Of these, 1,471 were duplicates that were removed, leaving 1,595.

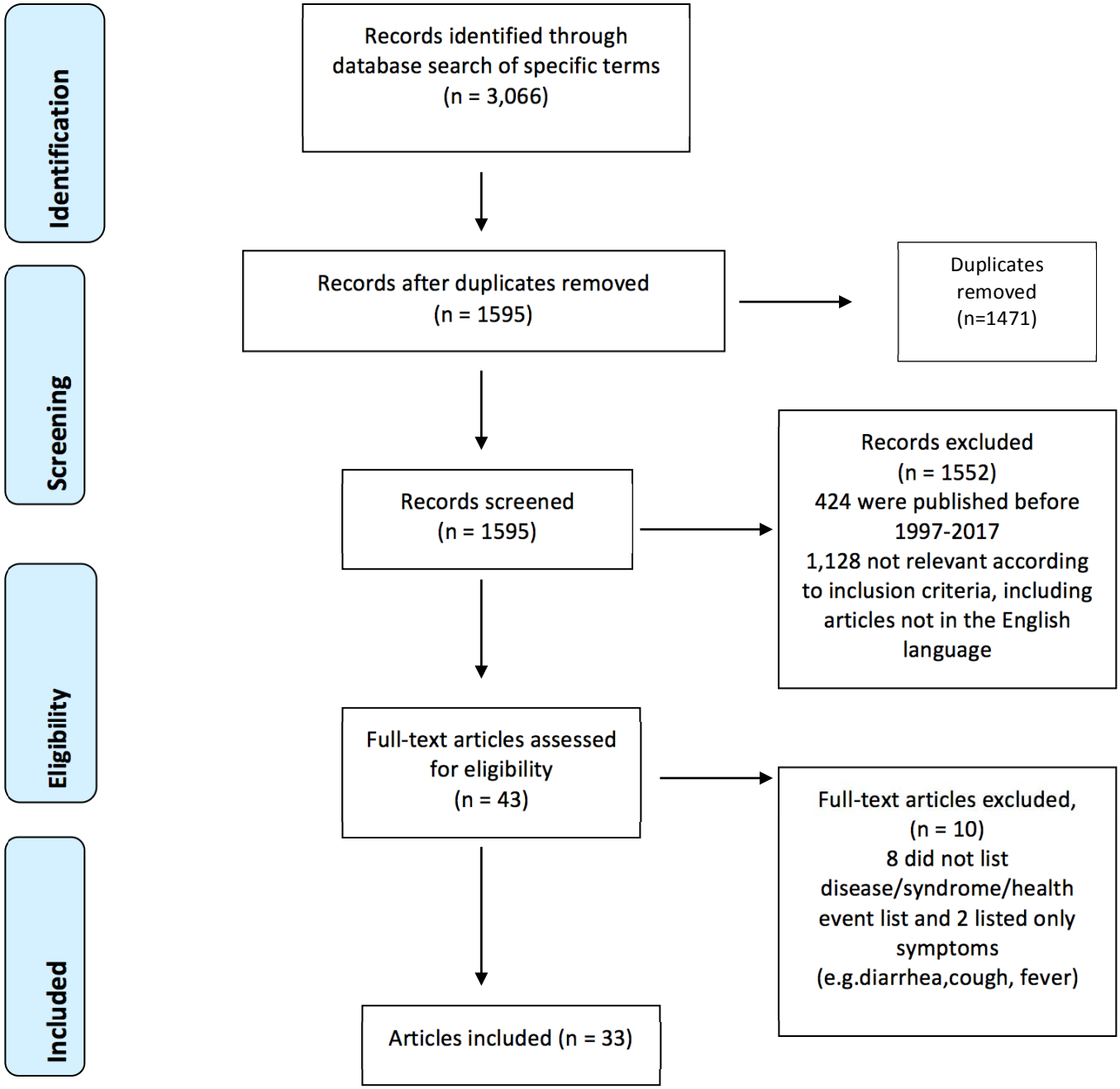
The 1,595 articles were screened for relevance to the topic using the following inclusion criteria:

- Year of publication from 1997 to June, 2017
- Reports on a communicable disease surveillance system intended to provide early warning for disease outbreaks following an emergency or disaster i.e. an EWARN-like system. Or it is a guideline for EWARN-like systems
- Published in the English language

Of the 1,595 articles, 424 were published earlier than the prescribed period. These were removed, leaving 1,171. Screening continued through title and abstract review resulting in 1,128 articles excluded for not fulfilling the inclusion criteria. The full texts of the remaining 43 articles were assessed for eligibility to be included in the final article list. The criterion for eligibility was that the article lists diseases/syndromes/health events that were included in the EWARN-like system. A guideline would advise on disease selection and list recommended diseases for surveillance. Following eligibility assessment, 10 articles were

excluded, as a disease list was not provided. The final article count for inclusion was 33.

Figure 2: PRISM Diagram of articles included in review



The 33 articles described EWARN-like systems implemented from 1997-2017, with a total of 20 individual systems detailed across 17 countries (Table 3).

(Table 3) Table 3: Reference list and EWARN-like systems 1997-2017 by country/region

System Count	Country	Region[2]	System start year	Name of system	Type	Reference	Ref count
1.	Albania	Europe	1999	Emergency surveillance system for communicable disease	Complex humanitarian emergency (CHE)	• (Valenciano M, 1999)	1.
2.	Albania	Europe	2000	ALERT	Post emergency[3]	• (Mata, 2011)	2.
3.	China	Western Pacific	2008	Emergency response mobile phone-based information system for infectious disease reporting	Earthquake	• (Yang, 2009) • (Ma, 2009)	3 4.
4.	Darfur	Africa	2003	EWARN	CHE	• (Pinto, 2005) • (Morof D.F. , 2013)	5 6.
5.	Fiji	Western Pacific	2016	Fiji EWARS in a box	Cyclone/typhoon	• (Fiji Ministry of Health and Medical Services, 2016)	7.
6.	Haiti	Americas	2010	Internally Displaced Persons Surveillance	CHE + Earthquake	• (Magloire R., 2010) • (Polonsky, 2013)	8. 9.

[2] WHO regional groupings (World Health Organisation, 2017e)
[3] Adapted to a national system from 1999 system set up for Kosovar refugees in Albania

System Count	Country	Region[2]	System start year	Name of system	Type	Reference	Ref count
				System (IDPSS)			
7.	Indonesia	South East Asia	2005	EWARN	Earthquake + tsunami	• (World Health Organisation, 2005b)	10.
8.	Iraq	Eastern Mediterranean	2003	Early Warning Surveillance System	CHE	• (Valenciano, 2003)	11.
9.	Myanmar	South East Asia	2008	Early Warning and Rapid Response (EWAR) surveillance system	Cyclone/typhoon	• (Myint, 2011)	12.
10.	Nigeria	Africa	2016	EWARS in a box	CHE	• (World Health Organisation, 2017b) • (World Health Organisation Regional Office for Africa, 2017a)	13. 14.
11.	Pakistan	Eastern Mediterranean	2005-2010	Disease Early Warning System (DEWS)	CHE + flood	• (Rahim, 2010)	15.
12.	Pakistan	Eastern Mediterranean	2010	Revised Disease Early Warning System (DEWS)	Flood	• (Sabatinelli G, 2012) • (Pakistan Federal Ministry of Health, 2010)	16. 17.
13.	Philippines	Western Pacific	2008	Surveillance in Post Extreme Emergencies and Disasters (SPEED)	Cyclone/typhoon	• (Salazar, 2017) • (Salazar, 2016) • (Department of Health	18.

System Count	Country	Region[2]	System start year	Name of system	Type	Reference	Ref count
						Republic of the Philippines, 2011)	19 20
14.	Serbia	Europe	2002	ALERT Serbia	CHE	• (Valenciano, 2004)	21
15.	Solomon Islands	Western Pacific	2013	EWARN	Earthquake + tsunami	• (Bilve, 2014)	22
16.	Somalia	Africa	2013	Communicable Disease Surveillance and Response System (CSR)	CHE	• (WHO Somalia, 2013) • (Cookson, 2013) • (Cordes, 2013)	23 24 25
17.	South Sudan	Africa	1999	IDSR (with EWARS)	CHE	• (Ministry of Health South Sudan & World Health Organisation, 2017) • (Ministry of Health South Sudan & World Health Organisation, 2017)	26 27
18.	Syria	Eastern Mediterranean	2012	EWARS	CHE	• (Syria Ministry of Health, 2017) • (Sparrow, 2016) • (Ismail, 2016)	28 29 30
19.	Syria	Eastern	2012	EWARN	CHE		

System Count	Country	Region[2]	System start year	Name of system	Type	Reference	Ref count
		Mediterranean				• (Assistance Coordination Unit, 2017a) • (Sparrow, 2016)	31
20.	Yemen	Eastern Mediterranean	2013	Electronic Disease Early Warning System (eDEWS)	CHE + famine	• (Ahmed, 2014) • (Ahmed, 2013)	32 33

The twenty systems were based in countries within all six World Health Organisation regional groupings (Table 4)

Table 4: WHO regional groupings; EWARN-like systems 1997-2017

WHO Region	System
Africa	Darfur (2003), Nigeria (2016), Somalia (2013), South Sudan (1999)
Americas	Haiti (2010)
South-East Asia	Indonesia (2004) Myanmar (2008)
Europe	Albania (1999), Albania (2000), Serbia (2002)
Eastern Mediterranean	Iraq (2003), Pakistan (2005), Pakistan (2010), Syria EWARS (2012), Syria EWARN (2012), Yemen (2013)
Western Pacific	China (2008), Fiji (2016), Philippines (2009), Solomon Islands (2013)

There were five (25%) systems that were set up after publication of the WHO 2012 guidelines, from 2013 to 2016 i.e. Fiji, Nigeria, Solomon Islands, Somalia, and Yemen. The remaining fifteen (75%) systems were established between 1997 and 2012.

The Eastern Mediterranean had the highest count of number of EWARN-like systems with six (30%). Followed by Africa at four (20%) and the Western Pacific with four (20%), Europe three (15%) South East Asia two (10%), and one (5%) in the Americas (Table 4).

There were thirteen (65%) EWARN-like systems that were set up in complex humanitarian emergencies (CHE); three of these involved natural disasters: earthquake, flood, and a famine. The Albania (2000) system is a permanent EWARN-like national system adapted from a system put in place for Kosovar

refugees in 1999. The remaining six (30%) EWARN-like systems were set up after natural disasters (Table 5).

Table 5: 1997-2017 EWARN-like systems by type of emergency or disaster

Type of emergency or disaster	Region	Systems count
Complex humanitarian emergency (CHE)	Africa	4
	Europe	3
	Eastern Mediterranean	3
CHE and famine	Eastern Mediterranean	1
CHE and flood	Eastern Mediterranean	1
CHE and earthquake	Americas	1
Total		**13 (65%)**
Cyclone/typhoon	Western Pacific	2
	South East Asia	1
Earthquake and tsunami	Western Pacific	1
	South East Asia	1
Flood	Eastern Mediterranean	1
Total		**6 (30%)**
Post CHE	Europe	**1 (5%)**

From 1997-2017 there were EWARN-like systems set up after 13 complex humanitarian emergencies (CHE) in Africa, Europe, the Eastern Mediterranean, and the Americas. The Western Pacific had 3 out of the 6 EWARN-like systems (50%) established solely after natural disasters.

The WHO 2012 guidelines advise including no more than 8-12 priority diseases/syndromes for surveillance in EWARN. Table 6 shows the EWARN-like systems total counts ranged from 8-38 or 9-21 if China (2008) is excluded[4]. Just

[4] Incomplete disease list and conflicting count from references (Yang, 2009) (Ma, 2009)

seven of the twenty systems monitored priority diseases/syndromes within the WHO recommended number range. And of these, Fiji and the Solomon Islands were set up after 2012. Of the total five systems post 2012 systems (Fiji, Nigeria, Solomon Islands, Somalia, Yemen) the diseases/syndromes range was 11-17, with an average of 14.2 diseases/syndromes included in EWARN.

Table 6: Total number of priority diseases/syndromes included in EWARN-like systems 1997-2017

Region: System	Number of priority diseases/syndromes	Regional average
Africa		**14.5**
Darfur (2003),	15	
Nigeria (2016),	17	
Somalia (2013)	15	
South Sudan (1999)	11	
Americas:		**N/A**
Haiti- 2010	19	
South East Asia		**12.5**
Indonesia (2004)	10	
Myanmar (2008)	15	
Europe		**11**
Albania (1999)	13	
Albania (2000)	9	
Serbia (2002)	11	
Eastern Mediterranean		**15.3**
Iraq (2003)	21	
Pakistan (2005),	14	
Pakistan (2010),	13	
Syria EWARS (2012),	16	
Syria EWARN (2012),	12	
Yemen (2013)	16	
Western Pacific		**14.7**
Fiji (2016)	11	
Philippines (2009),	21	
Solomon Islands (2013)	12	

*Plus China (2008) with 8 or 38 diseases/syndromes. Excluded from table due to uncertainty over number of diseases/syndromes.

The following systems had priority disease/syndrome counts within the recommended range: Albania (2000), Fiji (2016), Indonesia (2004), Serbia (2002), Solomon Islands (2013) South Sudan (1999), Syria EWARN (2012).

As highlighted earlier the WHO (2012) guidelines specifically recommend including the following diseases/syndromes in EWARN: suspected cholera or acute watery diarrhoea, suspected shigellosis or acute bloody diarrhoea, acute flaccid paralysis (poliomyelitis), acute jaundice syndrome, acute haemorrhagic fever, suspected measles, suspected bacterial meningitis, confirmed malaria.

Pakistan (2005) and Somalia (2013) were the only EWARN-like systems that included all eight recommended diseases/syndromes (Appendix 11). [5] Haiti (2010), Pakistan (2010), and the Philippines (2009) included seven; with malaria being the common omission; 'suspected malaria' used instead in the former, and complete exclusion for the latter two.

However, all twenty of the 1997-2017 systems included acute watery diarrhoea, acute bloody diarrhoea, and suspected measles (including syndrome of 'acute fever and rash')(Appendix 11).

The recommended diseases/syndromes most frequently left out of EWARN were: acute flaccid paralysis (n=8) and acute haemorrhagic fever (n=6). Notably, two of the systems that excluded acute flaccid paralysis (Solomon Islands, and Fiji), and one that excluded acute haemorrhagic fever (Fiji), were established after publication of the 2012 guidelines (Table 7) .

[5] Complete disease/syndrome list and/or case definitions not located for Nigeria (2016). The incomplete list is only missing WHO 2012 recommended acute jaundice syndrome

Table 7: WHO (2012) EWARN recommended diseases/syndromes not included in 1997-2017 EWARN-like systems

Recommended disease/syndrome	Systems not including recommended disease/syndrome	Regions
Acute jaundice syndrome	Albania (1999) Yemen (2013), Nigeria (2016)[6], South Sudan (1999)	Africa 2, Europe 1, Eastern Mediterranean 1
Acute haemorrhagic fever	Albania (1999) China (2008), Darfur (2003) Fiji (2016) Indonesia (2004) Iraq (2003) Myanmar (2008), South Sudan (1999)	Africa 2, Europe 1, Eastern Mediterranean 1, South East Asia 2, Western Pacific 2
Acute flaccid paralysis	Albania (2000), China (2008), Fiji (2016), Indonesia (2004), Iraq (2003), Myanmar (2008), Serbia (2002), Solomon Islands (2013)	Europe 2, Eastern Mediterranean 1, South East Asia 2, Western Pacific 3
Suspected meningitis	Solomon Islands (2013), Serbia (2002)*	Europe 1, Western Pacific 1
Malaria (confirmed)	*Albania (1999) Albania (2000), China (2008)[7] *Fiji (2016), Haiti (2010)[8] *Serbia (2002), Yemen (2013)	Americas 1, Europe 3, Eastern Mediterranean 1, Western Pacific 2

*Non-endemic for malaria

Acute respiratory infections were priority diseases/syndromes listed in all systems except Somalia (2013).[9] And even then, Somalia (2013) included suspected whooping cough, suspected diphtheria, and severe acute respiratory infections (SARI). Only nine systems included ARI specific to LRTI or pneumonia,

[6] Case definitions not located and not all syndromes listed i.e. 17 syndromes stated but all not listed within references (WHO Regional Office for South East Asia, 2017) (World Health Organisation Regional Office for Africa, 2017a)
[7] Incomplete disease list from references (Yang, 2009) (Ma, 2009)
[8] Suspected malaria, instead of confirmed malaria, included: Appendix 9
[9] Including ARI or ILI or URTI and/or LRTI, pneumonia

which was recommended by the WHO 2012 guidelines if ARI was included in EWARN (Table 8). Of these nine systems three (Darfur, Haiti, Pakistan (2010)) included ARI specific to LRTI through review of available case definitions. The remaining six EWARN-like systems (Albania (2000), Iraq, Myanmar, Pakistan (2005), Serbia, Yemen) had categories for ARI that explicitly included LRTI or pneumonia.

Table 8: Acute respiratory infection (ARI) in EWARN-like systems 1997-2017

Category of ARI included	System
None	Somalia (2013) [10]
ARI (unspecified) or influenza like illness (ILI)	Albania (1999) [11] China (2008) [11], Fiji (2016)[12] Indonesia (2004) [11,] Nigeria (2016), Philippines (2009), Solomon Islands (2013), South Sudan (1999), Syria EWARN (2012)[13],
ARI (specific to LRTI) or LRTI or pneumonia	Albania (2000), Darfur (2003), Haiti (2010)[14], Iraq (2003), Myanmar (2008), Pakistan (2010), Pakistan (2005), Serbia (2000), Yemen (2013)
Upper respiratory tract infection (URTI)	Albania (2000), Iraq (2003), Pakistan (2005), Serbia (2000), Yemen (2013)
Both URTI and LRTI/pneumonia	Albania (2000), Iraq (2003), Pakistan (2005), Serbia (2000), Yemen (2013)
Pneumonia	Iraq (2003), Myanmar (2008), Yemen (2013)
SARI	Somalia (2013), Syria EWARN (2012), Syria EWARS (2012)

[10] Included suspected diphtheria, suspected whooping cough, and SARI. Case definitions: Appendix 7.1

[11] Case definitions not located

[12] Fiji case definitions: Appendix 6

[14] Haiti Case definitions: Appendix 9

There were seven EWARN-like systems that included ARI not specific to LRTI: URTI was a priority disease/syndrome in Albania, Iraq, Pakistan (2005), Serbia, and Yemen; Fiji and the Solomon Islands included influenza like illness.

It is important to note that ARI was included as a priority syndrome in four systems (Albania, China, Indonesia, Nigeria, South Sudan) except case definitions could not be located. Therefore it was not determined if these were specific to LRTI/pneumonia. Somalia (2013), and both Syrian systems included severe acute respiratory illness (SARI) .

The WHO (2012) guidelines further specifically recommend that the following diseases/syndromes not be included in EWARN: other diarrhoeal disease (not suspected cholera or shigellosis), acute respiratory infection (not specific to lower respiratory tract infection or pneumonia), upper respiratory tract infection, suspected malaria, and malnutrition. Sixteen of the twenty EWARN-like systems (1997-2017) included at least one of these diseases/syndromes (Table 9).

Importantly, Fiji, Nigeria, and Yemen were all EWARN-like systems established after publication of the WHO (2012) guidelines, yet they included at least one disease/syndrome that was specifically recommended not to be included i.e. acute respiratory infection (influenza like illness), suspected malaria, and malnutrition.

Table 9: WHO (2012) specifically not recommended diseases/syndromes that were included in 1997-2017 EWARN-like systems

Not recommended diseases/syndromes	Systems including not recommended diseases/syndromes	Regions
Other diarrhoea	Pakistan (2005-2010), Pakistan (2010), Yemen (2013)	Eastern Mediterranean 3
Acute respiratory infection (not specific to lower respiratory tract infection or pneumonia) – includes influenza like illness	Albania (1999) [15], China (2008)[15] , Indonesia[15] (2004), Nigeria (2016) [15], Philippines (2009), Fiji (2016)[16], Solomon Islands (2013) [16], Syria EWARS (2012) [16]	Africa1, Europe 1, Eastern Mediterranean 1, South East Asia1, Western Pacific 4
Upper respiratory tract infection	Albania (2000), Iraq (2003), Pakistan (2005-2010), Serbia (2002), Yemen (2013)	Europe 2, Eastern Mediterranean 3,
Suspected malaria	Haiti (2010), Nigeria (2016), Pakistan (2010)	Africa 1, Americas 1, Eastern Mediterranean 1
Malnutrition	Darfur (2003), Iraq (2003), Nigeria (2016), Philippines (2009)	Africa 2, Eastern Mediterranean 1, Western Pacific 1

Tables 10-11 list the other communicable diseases included in 1997-2017 EWARN-like systems by system and then by region. The 'others' category was the most commonly included other communicable disease in the EWARN-like systems (n=6), followed by tetanus (n=5) and neonatal tetanus (n=5).

[15] Case definitions not located
[16] Influenza like illness

Table 10: Other priority communicable diseases/syndromes included in 1997-2017 EWARN-like systems

Other communicable diseases	Systems
Acute gastro intestinal disease without diarrhoea	Serbia (2002)
Acute viral hepatitis	Yemen (2013)
Confirmed dengue	Indonesia (2004), Yemen (2013)
Conjunctivitis	Philippines (2009)
Fever with other symptoms not listed	Philippines (2009)
Food poisoning	China (2008)
Guinea worm	South Sudan (1999)
HIV/AIDS patient with interrupted anti retroviral therapy (ART)	Haiti (2010)
Leishmaniasis	Syria EWARS (2012), Yemen (2013)
Lice	Albania (1999)
Meningoencephalitis	China (2008), Serbia (2002)
Mumps	Iraq (2003)
Neonatal tetanus	Albania (1999), Iraq (2003), Somalia (2012), South Sudan (1999), Yemen (2013)
Others	Albania (1999), Darfur (2003), Nigeria (2016), Pakistan (2010), Serbia (2002), Syria EWARN (2012)
Pertussis (confirmed)	Yemen (2013)
Prolonged fever	Fiji (2016), Solomon Islands (2013)
Pulmonary tuberculosis	Iraq (2003)
Scabies	Albania (1999), Pakistan (2005)
Schistosomiasis	Yemen (2013)
Sexually transmitted infection	Myanmar (2008)
Skin diseases	Philippines (2009)
Suspected cutaneous anthrax	Haiti (2010)
Suspected dengue	Fiji (2016), Myanmar (2008), Solomon Islands (2013)
Suspected dengue haemorrhagic fever	Myanmar (2008)

Suspected diphtheria	Haiti (2010), Iraq (2003), Somalia (2012)
Suspected leptospirosis	Philippines (2009)
Suspected rabies	Haiti (2010)
Suspected scrub typhus	Somalia (2012), Solomon Islands (2013)
Suspected typhoid fever	Haiti (2010), Syria EWARS (2012)
Suspected whooping cough (pertussis)	Haiti (2010), Iraq (2003)
TB patient with interrupted treatment	Haiti (2010)
Tetanus	Haiti (2010), Indonesia (2004), Iraq (2003), Myanmar (2008), Philippines (2009)
Typhoid fever	Iraq (2003)
Yellow fever	South Sudan (1999)
Zika like illness	Fiji (2016)

Table 11: Other priority communicable diseases/syndromes included in 1997-2017 EWARN-like systems by region

Region	List of other diseases
Africa	Guinea worm 1, neonatal tetanus 2, suspected diphtheria 1, suspected scrub typhus 1, yellow fever 1, others 2
Americas i.e. Haiti (2010)	HIV/AIDS patient with interrupted anti retroviral therapy (ART), suspected cutaneous anthrax, suspected diphtheria, suspected rabies, suspected typhoid fever, suspected whooping cough (pertussis), TB patient with interrupted treatment, tetanus,
Eastern Mediterranean	Leishmaniasis 2, mumps 2, neonatal tetanus 2, pertussis (confirmed) 1, suspected whooping cough (pertussis) 1, pulmonary TB 1, scabies, schistosomiasis 1, suspected diphtheria 1, suspected typhoid fever 1, typhoid fever 1, tetanus 1, others 2
Europe	Lice 1, meningoencephalitis 1, neonatal tetanus 1, scabies 1, others 2
South East Asia	Sexually transmitted infection 1, suspected dengue 1, suspected dengue haemorrhagic fever 1, tetanus 2
Western Pacific	Fever with other symptoms not listed 1, food poisoning 1, meningoencephalitis 1, prolonged fever 2, skin disease 1, suspected dengue 2, suspected leptospirosis 1, suspected scrub typhus 1, tetanus 1

Non-communicable disease/health events were also included in a number of systems; with animal bites (n=2), injuries (n=2), war related injuries (n=2), and mental health/psychological issues (n=2) the most commonly included (Table 12).

Table 12: Non-communicable diseases included in EWARN-like systems 1997-2017

Non-communicable diseases	Systems
Acute asthma attack	Philippines (2009)
Cardiovascular diseases	Albania (1999)
Fractures	Philippines (2009)
High blood pressure	Philippines (2009)
Injuries	Darfur (2003), Iraq (2003)
Known diabetes mellitus	Philippines (2009)
Maternal death	Nigeria (2016)
Mental health/psychological disorders	Albania (1999), Nigeria (2016)
Neonatal death	Nigeria (2016)
Open wounds/bruises/burns	Philippines (2009)
Road traffic injuries	Iraq (2003)
Snake bite/animal bites	Myanmar (2008), Philippines (2009)
Third trimester pregnancy without previous or pregnancy complications	Haiti (2010)
Trauma	Myanmar (2008)
Unexploded ordinance injuries	Iraq (2003)
War related injuries	Albania (1999), Iraq (2003)

Syndrome/disease/health event findings specific to each of the EWARN-like systems are detailed in the next section.

System specific

Albania, 1999

According to Valenciano (1999), from March to June 1999, 442,000 refugees fleeing the conflict in Kosovo were hosted by Albanian families or in refugee camps (Valenciano,1999). The Albanian Ministry of Health, together with the

WHO, set up an emergency surveillance system for communicable disease to facilitate early warning of outbreaks amongst the Kosovar refugee population.

Disease selection was syndromic based, and reported by Valenciano (1999) as based on diseases that were considered hazards in refugee situations, namely: acute watery diarrhoea, dysentery, acute respiratory infection, scabies, measles, and suspected meningitis (Table 13). The 1997 refugee health guidelines from Médecins Sans Frontières were referenced in selection of these diseases (Medecins Sans Frontieres, 1997). Acute flaccid paralysis, and neonatal tetanus were also included. Other diseases were selected based on the context of the emergency (i.e. refugees fleeing armed conflict) with psychological disorders and war injuries included in surveillance. A category of 'others' was also included to record all consultations not under the list of priority diseases/health events.

Return of Kosovar refugees began soon after agreement in the June 9th 1999 peace accord, and by July 8th 362,812 refugees had returned to Kosovo with 116,411 still in Albania (Valenciano, 1999). Although the system continued at time of publication of Valenciano (1999), diminishing refugee population resulted in camp closures, and fewer reporting units.

However, Valenciano (1999) stated that a surveillance alert system would be developed for the early detection of outbreaks among the Albanian population.

Table 13: Comparison to 2012 WHO guideline – Albania, 1999

Case definitions	Not provided in publication (Valenciano M, 1999)
Duration	1999-2000
Reason/objectives for set up	For early detection and control outbreaks amongst the refugee population
Similarities	Includes: acute watery diarrhoea, dysentery/bloody diarrhoea, acute flaccid paralysis, measles, and suspected meningitis.
Differences	Includes: meningitis, acute respiratory infection (does not specify lower respiratory tract infection), neonatal tetanus, scabies, lice, psychological disorders, war injuries, cardiovascular disease, and others. Excludes: acute jaundice syndrome, acute haemorrhagic fever syndrome, confirmed malaria (non-endemic country)
Number of priority diseases/syndromes	13

Albania, 2000

During a 2011 evaluation of Albania's communicable disease surveillance systems, ALERT was described as an early warning system for infectious diseases in Albania set up by WHO in 2000. ALERT meaning 'alarm', and also an acronym for the Albanian Epidemiological Reporting Tool (Mata, 2011). Notable differences from the 1999 system were that war related syndromes (injuries and psychological) and acute flaccid paralysis neonatal tetanus, scabies, and the others category were removed; and lower respiratory tract infection (LRTI),

upper respiratory tract infection (URTI), jaundice, unexplained fever, and haemorrhage with fever were added.

Table 14: Comparison to 2012 WHO guideline – Albania ALERT

Case definitions	Not provided in publication (Mata, 2011)
Duration	2000-current
Reason/objectives for set up	Early warning system for infectious diseases in Albania
Similarities	Includes: diarrhoea without blood, diarrhoea with blood, lower respiratory tract infection, rash with fever, jaundice, haemorrhage with fever, suspected meningitis.
Differences	Includes: upper respiratory tract infection, unexplained fever. Excludes: acute flaccid paralysis, confirmed malaria (non-endemic country)
Number of priority diseases/syndromes	9

China, 2008

Yang (2009) report that on 12 May 2008, an earthquake with a magnitude of 8.0 struck the North Western part of Sichuan province, China. More than 80 000 people were killed and 5 million more internally displaced.

An early need was for early warning of epidemic-prone diseases to facilitate early response to prevent outbreaks. According to Ma (2009), prior to the earthquake local health-care agencies were mandated by law to report 38 types of infectious diseases through the Chinese national internet-based direct reporting information (Chinese information system for disease control and

prevention (CISDCP)) established in 2004 in response to the 2003 SARS epidemic(Ma, 2009). However, following the earthquake, the system was not functional due to damage to landline communications for broadband and dial up Internet services. In response the Chinese Center for Disease Control and Prevention (China CDC) developed an emergency reporting system that used mobile phones and short messaging system (SMS). Information on a case would be sent by encrypted text message to the national database and include 16 categories of information: patient name, age, diagnosis, time and location. All data, besides names, were inputted using numerical codes used in the existing CISDCP (Yang, 2009).

Ma (2009) reports that the diseases or syndromes selected for reporting included fever with respiratory syndrome, rash and fever, diarrhoea (watery stool), diarrhoea (bloody stool), acute jaundice, encephalitis or meningitis, other fever illnesses, and food poisoning (Table 15). However, Yang (2009) report that the system covered the "the same 38 infectious diseases reported in CISDCP" (Yang, 2009). Both publications include authors from Chinese government health agencies. [17,18]

[17] Ma et al.: National Center for Public Health Surveillance and Information Services in the Chinese Center for Disease Control and Prevention

[18] Yang et al: State Key Laboratory of Remote Sensing Science, Jointly Sponsored by the Institute of Remote Sensing Applications, Chinese Academy of Sciences and Beijing Normal University, Beijing, 100101, China. b Sichuan Center for Disease Control and Prevention, Chengdu, China.

Table 15: Comparison to 2012 WHO guideline – China, 2008

Case definitions	Not provided in publication(Ma, 2009) (Yang, 2009)
Duration	2008 - unknown
Reason/objectives for set up	Early warning of epidemic-prone diseases to facilitate early response to prevent outbreaks
Similarities	Includes diarrhoea (watery stool), diarrhoea (bloody stool) rash and fever (suspected measles), acute jaundice, meningitis
Differences	Includes: fever with respiratory syndrome, encephalitis, other fever illnesses, and food poisoning. Excludes: acute flaccid paralysis, acute haemorrhagic fever syndrome, and confirmed malaria. [19]
Number of priority diseases/syndromes	8 or 38

Darfur, 2003

In the crisis in Darfur between March 2003 and December 2008, 80% of the estimated excess deaths (300,000) registered during the stabilization period were not caused by violence, and have been attributed to communicable diseases, particularly diarrhoea (Degomme et al., 2010). The WHO and partners established an EWARN in Darfur, following increased internal population displacement with Darfuris fleeing their homes as a result the deterioration of the security situation due to escalation of militia and rebel led attacks on local populations (Morof et al, 2013). Pinto et al describe strengthening the early warning function of the national surveillance system by setting up an early warning system for epidemic prone diseases in Darfur in 2003 (Pinto, 2005).

[19] However, poliomyelitis and malaria are listed as 2 of the 38 CISDCP diseases (Wang et al., 2013).

In the 2013 evaluation of EWARN in Darfur, Morof et al stated that initially 12 health events were included for surveillance i.e. acute watery diarrhoea, bloody diarrhoea, acute flaccid paralysis, acute jaundice syndrome, acute respiratory infection, injuries, malaria (suspected and confirmed), neonatal tetanus (suspected and confirmed), severe malnutrition, suspected measles, suspected meningitis, unexplained fever (Table 16). In 2006 the 'others' category was added to record all other medical conditions not meeting the other case definitions. This became a total of 13 health events, with largely syndromic case definitions, listed in Appendix 3.

Table 16: Comparison to 2012 WHO guideline – Darfur, 2003

Case definitions	Provided in publication (Morof D.F. , 2013), (Pinto, 2005)
Reason/objectives for set up	• Early detection of outbreaks of epidemic prone disease • Monitor communicable disease trends to direct public health action • To estimate the workload of health units attending to affected population, to improve resource allocation
Similarities	Includes: acute watery diarrhoea, bloody diarrhoea, acute flaccid paralysis, acute jaundice syndrome, suspected measles, suspected meningitis, malaria (confirmed), acute respiratory infection (case definition specific for LRTI)
Differences	Includes: injuries, suspected malaria, neonatal tetanus, severe acute malnutrition, unexplained fever, others. Event based surveillance – unusual death, or cluster of health events reports by community leaders. Excludes: acute haemorrhagic fever syndrome
Number of priority diseases/syndromes	13 + 2 event based = 15

Fiji, 2016

The Fiji Ministry of Health and Medical Services, with assistance from WHO, established an EWARN (Fiji EWARS in a box) in March 2016 in the aftermath of the destruction caused by category 5 Cyclone Winston.[20] According to the Fiji Government's Post Disaster Needs Assessment, approximately 540,400 people, or 62% of the population were impacted by the cyclone. There were 44 fatalities

[20] Category 5 cyclones have average wind speeds of more than 200 km/h (123miles/h) and gusts of more than 279 km/h (173.4miles/h)(Hurricane Research Division & National Oceanic and Atmospheric Administration NOAA, 2014)

and approximately 40,000 people required immediate assistance following the cyclone. There was damage or destruction of 30,200 houses, 495 schools, 88 health clinics and medical facilities, (Government of Fiji, 2016) .

A rapid public health risk assessment identified water borne and vector borne diseases that posed a medium to high risk for outbreaks i.e. leptospirosis, diarrhoea (including dysentery), typhoid, and mosquito borne diseases including dengue, Chikungunya, and Zika virus. An increased risk of respiratory infections was also noted due to overcrowding in displacement camps(Fiji MOHMS,2016). Based on the risk assessment, the syndromes/diseases in Table 17 were selected for weekly reporting in EWARS in a Box (Fiji):

Table 17: Comparison to 2012 WHO guideline – Fiji, 2016

Case definitions	Provided in publication (Fiji Centre for Communicable Diseases Control Ministry of Health and Medical Services & WHO Division of Pacific Technical Support Fiji, 2016) (Appendix 6)
Duration	2016-current
Reason/objectives for set up	Supplement existing systems to ensure that MOHMS was able to adequately monitor burden of communicable diseases and detect potential disease outbreaks in a timely fashion.
Similarities	Includes: acute watery diarrhoea, bloody diarrhoea, acute jaundice syndrome, acute fever and rash (suspected measles), suspected meningitis.
Differences	Includes influenza like illness (does not specify lower respiratory tract infection), prolonged fever (indicator for typhoid fever), suspected dengue, Zika-like illness. Event based surveillance – unusual death, or cluster of health events. Excludes: acute flaccid paralysis, confirmed malaria (non-endemic country)
Number of priority diseases/syndromes	9 (only indicator based) or 11 (including event based surveillance)

Haiti, 2010

After the 2010 earthquake in Haiti, the Center for Disease Control and Prevention (ECDC European Center for Disease Prevention and Control) and the Pan American Health Organisation (PAHO) created the Internally Displace Persons Surveillance System (IDPSS). The aim of the system was to monitor

communicable diseases reports from temporary health facilities established for IDPs following the earthquake. According to (Magloire R., 2010) IDPSS was a voluntary, passive surveillance system, targeting 19 priority conditions: six requiring immediate public health notification; 10 suspected communicable diseases of outbreak potential; and 3 defined as programmatic indicators (Appendix 9) .

Table 18: Comparison to 2012 WHO guideline – Haiti, 2010

Case definitions	Provided in publication (Magloire R., 2010)
Duration	2010 - unknown
Reason/objectives for set up	• Establish monitoring of communicable diseases identified in temporary clinics serving IDPs. • Detect and respond to outbreaks of epidemic prone diseases • Monitor disease with greatest public health risk to IDPs
Similarities	Includes: watery diarrhoea, bloody diarrhoea, acute flaccid paralysis, acute febrile illness with jaundice, acute haemorrhagic fever syndrome, suspected measles, suspected meningococcal meningitis, acute respiratory infection (case definition is specific to LRTI)
Differences	Includes: suspected malaria, fever of unknown cause, suspected rabies, suspected typhoid, tetanus, suspected whooping cough, suspected cutaneous anthrax. Programmatic indicators – tuberculosis patient with interrupted treatment, HIV/AIDS patient with interrupted antiretroviral therapy, third trimester pregnancy without previous or pregnancy complications. Excludes: confirmed malaria
Number of priority diseases/syndromes	19

Indonesia, 2004

According to the WHO (World Health Organisation, 2005c) Aceh Province, with a population of 4.8 million, in Indonesia was the most severely affected by the 26th

December 2004 Indian Ocean earthquake and tsunami. As of 22 March 2005 there were 126,602 confirmed deaths and 93,638 missing, and 514,150 IDPs (World Health Organisation, 2005c). A 2005 survey of 1653 displaced households in 9 tsunami affected districts in Aceh reported that crude mortality rates in the survey areas ranged from a high of 23.6% in Aceh Jaya district on the west coast to 5.3% on the east coast (Doocy, 2007). The province had also been subject to decades of civil unrest prior to the disaster, with resulting impact on economic and social development.

With the extensive loss of health infrastructure and human resources, the Ministry of Health collaborated with teams from WHO including the Global Outbreak Alert and Response Network (GOARN) to develop an surveillance/early warning and response system (EWARN) for the early detection of epidemic prone diseases to facilitate rapid response (World Health Organisation, 2005c).

An early warning syndromic surveillance system was set up to target the following diseases/conditions of epidemic potential: acute watery diarrhoea, bloody diarrhoea, dengue, fever of unknown origin, jaundice, measles, meningitis, and malaria (Table 19). The system also targeted acute respiratory infections and tetanus. It is noteworthy that the publication describing the system made a distinction between these two diseases as being of public health importance compared to the previous eight that were of epidemic potential (WHO, 2005).

Table 19: Comparison to 2012 WHO guideline – Indonesia, 2004

Case definitions	Not provided in publication (World Health Organisation, 2005c)
Duration	2004- end unknown
Reason/objectives for set up	• Detection of epidemic prone diseases
Similarities	Includes: acute watery diarrhoea, bloody diarrhoea, jaundice, measles, meningitis, and malaria.
Differences	Includes: dengue fever, fever of unknown origin, acute respiratory infections (not specific), and tetanus. Excludes: acute flaccid paralysis
Number of priority diseases/syndromes	10

Iraq, 2003

Valenciano (Valenciano, 2003) describes the communicable disease surveillance and control system set up by the WHO in Basrah Southern Iraq from April to May 2003. This followed the destruction of health infrastructure, including public health and hospital based surveillance systems, after the start of the Iraq war. Within this EWARN-like system all health facilities in Basrah were to report on 20 priority health events described in Table 20.

Table 20: Comparison to 2012 WHO guideline – Iraq, 2003

Case definitions	Not provided in publication (Valenciano, 2003)
Duration	2003 -
Reason/objectives for set up	• Early warning of infectious disease outbreaks • To provide control programs with impact indicators
Similarities	Includes: acute watery diarrhoea, acute bloody diarrhoea, acute jaundice, measles (suspected), meningitis (suspected), pneumonia, and malaria.
Differences	Includes: Upper respiratory tract infections, severe malnutrition, typhoid fever, diphtheria (suspected), whooping cough (suspected), tetanus (adult), tetanus (neonatal), mumps, pulmonary tuberculosis, fever of unknown origin, injuries, war related injuries, unexploded ordinances injuries, road traffic injuries. Excludes: acute flaccid paralysis
Number of priority diseases/syndromes	21

Myanmar, 2008

Cyclone Nargis made landfall in Mynamar on May 2nd 2008. According to the International Federation of the Red Cross and Red Crescent Societies (IFRC) 84,500 people were killed and approximately 2.4 million people were affected. Several hundred thousands of people were estimated to have been without shelter(IFRC, 2011). The WHO Myanmar Health Cluster Joint Action Plan found that population displacement, weakening of the health system due to impact of the cyclone, and the endemicity of a number of outbreak prone communicable disease (e.g. malaria and dengue fever) in the cyclone affected area resulted in an elevated risk of outbreaks (Myanmar Health Cluster, 2008). Therefore, the Myanmar Ministry of Health (MMOH) and the WHO set up the Early Warning and

Rapid Response (EWAR) surveillance system to detect and respond to potential disease outbreaks (Myint, 2011). Priority disease/syndromes (Table 21) excludes acute flaccid paralysis and acute haemorrhagic fever syndrome.

Table 21: Comparison to 2012 WHO guideline – Myanmar, 2008

Case definitions	Not provided in publication (Myint, 2011)
Duration	2008 - unknown
Reason/objectives for set up	• To detect and respond to potential disease outbreaks
Similarities	Includes: suspected cholera (acute watery diarrhoea), bloody diarrhoea, acute jaundice, acute respiratory illness/pneumonia, suspected measles, suspected meningitis, malaria confirmed by rapid diagnostic test
Differences	Includes: suspected dengue, suspected dengue haemorrhagic fever, trauma cases, suspected tetanus, sexually transmitted infection, snake bites, and unexplained cluster of health events Excludes: acute flaccid paralysis, acute haemorrhagic fever syndrome
Number of priority diseases/syndromes	14

Nigeria, 2016

According to the WHO (2017b), the on-going conflict in northern Nigeria has resulted in an estimated 7 million people needing humanitarian assistance of which 3.7 million are in need of health interventions. Rapid assessments in Borno State revealed high population densities, inadequate food and shelter, unsafe water, poor sanitation and a lack of infrastructure. These circumstances indicated an increased risk of infectious disease outbreaks, and it was also noted that the existing national surveillance system (Integrated Disease Surveillance

and Response (IDSR)) was not performing adequately for early warning (WHO, 2017b) .

In response, in 2016 WHO set up 'EWARS in a box' a system of prepositioned kits made up of field ready equipment needed for establishing surveillance and response activities in low resourced field settings (WHO,2017b). In terms of disease selection for the system, the existing IDSR list of 7 national weekly diseases was expanded to provide mortality and morbidity data for 17 diseases and health events of public health importance. Details on the diseases selected and method of selection were not provided in the publication; however, it was reported that the majority of disease and death reports were attributed to malaria, with 50% morbidity and 52% mortality. Other significant contributors to morbidity were acute respiratory infection (12%), severe acute malnutrition (8%), and acute watery diarrhoea (7%).

However, the April 2017 WHO situation report for Northeast Nigeria reports the following EWARS diseases or syndromes: malaria (suspected and confirmed), acute respiratory infection, acute watery diarrhoea, bloody diarrhoea, severe acute malnutrition (SAM), measles, mental health, other, maternal death, neonatal death (World Health Organisation Regional Office for Africa, 2017a). Cases of meningitis were also reported in the bulletin. According to (WHO, 2017 #44) there were 17 priority diseases/syndromes in EWARS in a box Nigeria. However, not all have been reported in WHO situation reports, and a complete list of the 17 diseases/syndromes could not be located. The list of diseases/syndromes available is found in Table 22.

Table 22: Comparison to 2012 WHO guideline – Nigeria, 2016

Case definitions	Not provided in publication (WHO, 2017b) (WHO Regional Office for Africa, 2017a)
Duration	2016 - current
Reason/objectives for set up	• Detect and react rapidly to suspected disease outbreaks.
Similarities	Includes: acute watery diarrhoea, bloody diarrhoea, acute flaccid paralysis, acute haemorrhagic fever syndrome, measles (suspected), meningitis (suspected), and malaria (confirmed).
Differences	Includes: malaria (suspected), acute respiratory infection.[21] Severe acute malnutrition (SAM), mental health, other, maternal death, neonatal death Excludes: acute jaundice syndrome [22]
Number of priority diseases/syndromes	17[22]

Pakistan 2005, 2007, 2010

Rahim (2010) evaluated the performance of the Disease Early Warning System (DEWS) established in the aftermath of the 2005 Pakistan earthquake. DEWS was also used during floods in 2007, and again in 2010. According to the IDMC these three disasters combined displaced approximately 19 million people (IDMC, 2012) . According to Rahim (2010) DEWS was a weekly reporting system, covering 14 selected priority diseases and conditions of public health importance (Appendix 4). There was no information given on methods for selecting the diseases, however it was noted that measles, acute watery diarrhoea, acute jaundice syndrome, and dengue fever accounted for the majority of reported alerts and detected outbreaks (Rahim, 2010).

[21] Case definitions not available so cannot identify if it is all ARI or LRTI/pneumonia specific
[22] Complete 17-disease/syndrome list not available from referenced sources. Only 15 listed.

Table 23: Comparison to 2012 WHO guideline – Pakistan 2005, 2007, 2010

Case definitions	Not provided in publication (Rahim, 2010)
Duration	2005 – 2010 (activated 2005, 2007, 2010)
Reason/objectives for set up	• Early detection of potential outbreaks and opportunity for immediate response
Similarities	Includes: acute watery diarrhoea (suspected cholera), bloody diarrhoea, acute flaccid paralysis, acute jaundice syndrome, haemorrhagic fever, measles, meningococcal meningitis, acute lower respiratory infection, malaria[23]
Differences	Includes: acute upper respiratory tract infection, acute diarrhoea (non-cholera), unexplained fever, neonatal tetanus, and scabies. Excludes: None
Number of priority diseases/syndromes	14

Pakistan, 2010

Following the 2010 flooding, which resulted in 10 million people alone living without shelter, Pakistan's Ministry of Health requested assistance from WHO and CDC in strengthening DEWS. The resulting revision of DEWS was described by Sabatinellie (2012), who reported that health facilities and mobile clinics in flood-affected areas were expected to report case counts of 13 (reduced from the original 14) conditions considered to be epidemic-prone or of public health importance (Appendix 5).

There is no information provided on methods for selecting the 13 conditions nor why diseases/conditions from the original DEWS were omitted or amended.

[23] Case definitions not available so unclear if this is confirmed or suspected

However, Sabatinellie (2009) note that revision of DEWS increased system usefulness in subsequent emergencies and highlights the need to follow the 2012 WHO guidelines. Table 25 shows the diseases selected for DEWS before and after revision (pre and post 2010 floods).

Table 24: Comparison to 2012 WHO guideline – Pakistan, 2010

Case definitions	Provided in publication (Sabatinelli G, 2012) (Pakistan Federal Ministry of Health, 2010)
Reason/objectives for set up	• Early detection of potential outbreaks and opportunity for immediate response
Similarities	Includes: acute watery diarrhoea (suspected cholera), bloody diarrhoea, suspected measles, suspected meningitis, acute flaccid paralysis (suspected poliomyelitis), acute jaundice syndrome, acute haemorrhagic fever syndrome, acute respiratory infection (case definition is specific for LRTI/pneumonia)
Differences	Includes: suspected malaria, unexplained fever, and unknown disease occurring in cluster. Other diseases of public health importance: other diarrhoea (acute diarrhoea), other diseases (including skin diseases, dog bites, snake bites, eye and ear infections, injuries, heat stroke) Excludes: confirmed malaria.[24]
Number of priority diseases/syndromes	13

[24] Recommendation for confirming malaria in case definition, but not represented separately

Table 25: Pakistan Disease Early Warning System (DEWS) surveillance disease/condition comparison 2005-2010 and post 2010 revision

DEWS diseases/conditions 2005-2010	DEWS diseases/conditions post 2010 revision
Acute lower respiratory tract infection	Acute respiratory infection
Acute upper respiratory tract infection	N/A
Acute diarrhoea (non cholera)	Other diarrhoea
Acute watery diarrhoea (suspected cholera)	Acute watery diarrhoea (suspected cholera)
Bloody diarrhoea	Bloody diarrhoea
Haemorrhagic fever	Acute haemorrhagic fever syndrome
Acute jaundice syndrome	Acute jaundice syndrome
Malaria	Suspected malaria
Measles	Suspected measles
Meningococcal meningitis	Suspected meningitis
Acute flaccid paralysis	Acute flaccid paralysis (suspected poliomyelitis)
Unexplained fever	Unexplained fever
Neonatal tetanus	N/A
Scabies	N/A
N/A	Unknown disease occurring in cluster
N/A	Other diseases

Philippines, 2010

According to the Philippines Department of Health, in the last quarter of 2009, three tropical cyclones struck the Philippines successively causing massive floods and affecting over 2 million households. Outbreaks of communicable disease occurred amidst population displacement and poor sanitation. Notably a leptospirosis outbreak occurred in September 2009, in Manila; 471 patients were hospitalized and 51 (10.8%) died (Amilasan et al., 2012). The post incident evaluation of the response to the cyclones, and a Global Outbreak Alert and

Response Network (GOARN) investigation, recommended that an integrated public health monitoring system information system be established to provide early warning for potential post disaster disease outbreaks. The objective of the system would be to detect early any unusual increase of major public health problems including both communicable diseases and non-communicable diseases in emergencies and disasters (Department of Health Republic of the Philippines, 2011).

An EWARN-like system, Surveillance in Post Extreme Emergencies and Disasters (SPEED) was established to monitor 21 priority disease/health events described in Appendix 10. Importantly, the objectives of SPEED included the monitoring of non-communicable diseases as well as communicable diseases. This deviates from the main objective of EWARN i.e. to rapidly detect and respond to signals that might indicate outbreaks and clusters of epidemic-prone diseases (World Health Organisation, WHO Headquarters, WHO Regional Office for Africa, & WHO Country Office Nigeria, 2012). The inclusion of non-communicable diseases meant that priority diseases in SPEED were well above the recommended 8-12 (Table 26).

Table 26: Comparison to 2012 WHO guideline – Philippines, 2013

Case definitions	Provided in publication (Department of Health Republic of the Philippines, 2011)
Duration	2013 - current
Reason/objectives for set up	• Early detection of unusual increases or occurrences in communicable and non- communicable diseases/health conditions • Monitor health trends • Enable identification of appropriate response
Similarities	Includes: acute watery diarrhoea, acute bloody diarrhoea, acute flaccid paralysis, acute jaundice syndrome, acute haemorrhagic fever, suspected measles, suspected meningitis
Differences	Includes: acute respiratory infection (not specific to LRTI/pneumonia), suspected leptospirosis, fever with other symptoms not listed, open wounds/bruises/burns, fractures, skin diseases, animal bites, conjunctivitis, tetanus, high blood pressure, known diabetes mellitus, acute asthma attack, acute malnutrition Excludes: confirmed malaria..
Number of priority diseases/syndromes	21

Serbia, 2002

According to (Valenciano, 2004) at the end of the Kosovo war in 1999, the Serbian Republic Institute of Public Health (RIPH) began working to meet expected obligations in implementing effective early warning systems and investigation and response capacities; at the time being developed by the WHO through the revision of the International Health Regulations (IHR). In collaboration with the WHO/Emergency and Humanitarian Action Office in Belgrade, the RIPH conducted a review of the existing routine communicable

disease surveillance system. The findings were essentially that the existing system did not have the capacity for effective early warning of outbreaks of epidemic prone diseases (Valenciano, 2004).

As a result an EWARS was implemented in 2002 with the support of the WHO. The RIPH named the system ALERT, and its objective was to strengthen early detection of outbreaks of epidemic prone and emerging infectious diseases. ALERT was born out of the Kosovo war, implemented once it was over, and remained operational during flooding in the north east of the country in April 2005 (World Health Organisation, 2005d).

Table 27: Comparison to 2012 WHO guideline – Serbia, 2002

Case definitions	Not provided in publication (Valenciano, 2004)
Duration	2002 – unknown (in operation 2004)
Reason/objectives for set up	Early detection of outbreaks of epidemic prone and emerging infectious diseases.
Similarities	Includes: acute watery diarrhoea, acute bloody diarrhoea, acute jaundice syndrome, acute haemorrhagic fever syndrome, rash with fever, and lower respiratory tract infection. Number of priority disease = 11, within WHO recommendation.
Differences	Includes: upper respiratory tract infection, meningoencephalitis, acute gastrointestinal disease without diarrhoea, fever of unknown origin, others. Excludes: AFP, confirmed malaria (non-endemic country).
Number of priority diseases/syndromes	12

Solomon Islands, 2013

Bilve et al reported on the implementation of EWARN following a 2013 tsunami in the Santa Cruz Islands that killed 10 people, displaced over 4700, damaged or destroyed 1168 homes, damaged or destroyed water sources, and disrupted sanitation facilities (Government of the Solomon Islands, 2013). Bilve et al described that in the post disaster risk assessment, limited access to clean water, poor sanitation, high population density in displaced camps, living in bush and scrub and muddy environments, and increased exposure to disease vectors were all factors that increased risk of epidemic transmission.

It was in consideration of this risk assessment, and with the knowledge of an absence of an existing surveillance system, that EWARN was established with the assistance of the WHO (Bilve, 2014). Bilve (2014) reference the WHO EWARN guidelines, however there are deviations that are presented in Box 17.

Selection of disease for EWARN is described by Bilve (2014) with 8 target diseases and syndromes selected based on severity (life threatening or potentially life threatening), transmission potential (epidemic or possible epidemic capacity), and relevance to the post disaster setting (present or likely present) as described in the post disaster risk assessment(Bilve, 2014). Table 28 compares the system to the WHO 2012 guidelines, including diseases selected.

Table 28: Comparison to 2012 WHO guideline –Solomon Islands, 2013

Case definitions	Not provided in publication (Bilve, 2014)
Duration	2013 – ended (unknown time)
Reason/objectives for set up	• Early warning for outbreaks of outbreak-prone disease
Similarities	Includes: watery diarrhoea, bloody diarrhoea, acute fever and rash (suspected measles), acute jaundice syndrome, malaria (confirmed).
Differences	Includes: suspected dengue, suspected scrub typhus, influenza like illness, prolonged fever, unknown disease occurring in cluster, unusual health events, unexplained deaths. Excludes: acute flaccid paralysis, acute haemorrhagic fever syndrome, and meningococcal meningitis.
Number of priority diseases/syndromes	12

Somalia, 2012

Somalia has remained a complex state since the collapse of the government in 1991. The on-going conflict has led to poor infrastructure, including health. In August 2011, the Famine Early Warning Surveillance Network (Famine early warning systems network (FEWSNET)) reported a famine in five areas of Somalia, estimating that 3.2 million people were in need of immediate assistance (FEWSNET,2011), and as of 2017, the IDMC reported that an estimated 260,000 people had died (IDMC,2017).

Prior to 2011, Somalia had five surveillance systems, the Communicable Disease Surveillance and Response system (CSR), the Integrated Diseases Surveillance and Response system (IDSR), Measles, Malaria and, the Polio AFP surveillance. In response to the famine, WHO Somalia requested the CDC to assess the two of the existing disease surveillance systems, the CSR and IDSR. The result of the CDC review was the streamlining of the existing systems into the revised Communicable Disease Surveillance and Response (CSR) system (Cookson et al.,2013).

Significantly, for the purpose of this report, according to Cookson et al. (2013) disease selection for CSR was guided by the recently published 2012 WHO EWARN implementation guidelines (WHO, 2012). The result included a reduction of diseases under surveillance from sixteen in the original system, to nine epidemic-potential conditions at inception of CSR in January 2012 (Cookson et al., 2013).

According to the CSR field manual this limited number of priority diseases/conditions were selected based on a) their potential to cause epidemics, b) their association with high morbidity and mortality, c) the existence of interventions in Somalia, and d) targeted for elimination (WHO Somalia, 2013). The nine priority diseases were included for weekly surveillance and five additional conditions were included for immediate reporting. During the most recent revision in December 2012, these were modified to eight suspected or confirmed diseases for weekly surveillance and six additional immediately reportable syndromes (Appendix 7). Case definitions were not provided in the CSR field manual that was available online as appendices were included in a separate document that was not obtainable.

Table 29: Comparison to 2012 WHO guideline – Somalia, 2012

Case definitions	Provided in publication (Cookson, 2013; Cordes, 2013) (WHO Somalia, 2013)
Duration	2012 - current
Reason/objectives for set up	• Early warning for outbreaks of outbreak-prone disease
Similarities	Includes: suspected cholera, suspected shigellosis (dysentery), acute flaccid paralysis, acute jaundice syndrome, suspected haemorrhagic fever, suspected measles, suspected meningitis, confirmed malaria.
Differences	Includes: suspected diphtheria, suspected whooping cough (pertussis), neonatal tetanus, severe acute respiratory infection (SARI). Event based – rumour of unusual cluster of deaths, rumour of unusual cluster of health events Excludes: None
Number of priority diseases/syndromes	14

South Sudan, 2013

According to (World Health Organisation, 2002) South Sudan has a history of frequent displacement of its people, drought, famine, and disease outbreaks. WHO in 1999, in collaboration with other international agencies (IFRC, UNICEF etc.), established EWARN with the primary objective of early detection, alert and prompt investigation of suspected outbreaks.

Table 30: Comparison to 2012 WHO guideline South Sudan, 2013

Case definitions [25]	Not provided in publication (Ministry of Health South Sudan & World Health Organisation, 2017)
Duration	1999- current
Reason/objectives for set up	• Early warning for outbreaks of epidemic-prone disease • Rapid response to outbreaks
Similarities	Includes: acute watery diarrhoea, acute bloody diarrhoea, acute flaccid paralysis, suspected measles, viral haemorrhagic fever, suspected meningitis, malaria.
Differences	Includes: acute respiratory illness (not specified if LRTI/pneumonia).[26] Others, yellow fever, guinea worm, neonatal tetanus. Excludes: acute jaundice syndrome
Number of priority diseases/syndromes	12

[25] Information is likely incomplete as sole source are 2016-2017 health cluster situation reports (World Health Organisation Regional Office for Africa, 2017b) which may not list all priority diseases in the system

[26] Case definitions not included in situation report therefore cannot differentiate if ARI is specifically for LRTI/pneumonia as recommended in WHO 2012 guidelines

Syria, 2012

Since 2011, Syria has been embroiled in civil war between the Syrian government and the Free Syrian Army. The armed conflict have also involved foreign governments and groups such as Islamic State in Iraq and the Levant (ISIL) and the al-Nusra Front (IDMC, 2016a). According to the IDMC, Syrians were forced to flee their homes at short notice and repeatedly over time. As of December 2016, over one million people sought refuge in "last resort" IDP sites, sites that did not provide adequate living conditions, such as informal settlements, collective centres and makeshift housing, with 57% of collective centres not having sufficient water, 50% lacking sufficient sanitation facilities, and 54% being overcrowded. Also as of December 2016, an estimated 4.9 million people were trapped in hard-to-reach locations, including 0.97 million people in besieged areas (IDMC, 2016a).

A defining feature of the Syrian conflict has been continued violations of International Humanitarian Law by all parties, with targeting of densely populated areas, civilians, and civilian infrastructure, including medical facilities. According to the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), from January to September 2016, there were 101 reported attacks resulting in damage to hospitals and health care centres across Syria (UNOCHA, 2017) .

This targeting of the health system has compounded the effects of population displacement and conflict with a resultant resurgence of infectious disease. This

was highlighted by a polio outbreak in July 2013, when Syria had been polio free since 1999 (WHO, 2017d)

There are two early warning infectious disease surveillance systems operating in Syria: the Early Warning and Response System (EWARS) for Syria, established in 2012 and administered by the WHO and the Syrian Ministry of Health (WHO EMRO,2012), and the Early Warning and Response Network (EWARN), established in 2012 administered by the Assistance Coordination Unit , an organisation established by the Syrian National Coalition in 2012 in order to coordinate aid to non-government controlled areas (Assistance Coordination Unit, 2017b).

The diseases selected for surveillance for both systems are compared in Table 31.

Table 31: Early Warning and Response Network Assistance Coordination Unit (EWARN) and Early Warning and Response System (EWARS), WHO Syria and Syria Ministry of Health Priority Disease/Conditions under surveillance

Early Warning and Response Network Assistance Coordination Unit (EWARN)	Early Warning and Response System (EWARS), WHO Syria and Syria Ministry of Health:
N/A	Acute diarrhoea
Acute bloody diarrhoea (suspected shigellosis)	Bloody diarrhoea
Acute watery diarrhoea (suspected cholera)	Acute watery diarrhoea
Acute jaundice syndrome	Acute jaundice syndrome
N/A	Influenza like illness
Severe Acute Respiratory Illness	Severe acute respiratory illness
Acute flaccid paralysis (suspected poliomyelitis)	Acute flaccid paralysis
Leishmaniasis	N/A
Suspected measles	Suspected measles
Suspected meningitis	Suspected meningitis
Unusual cluster of health events	N/A
Unexplained death	N/A
Unexplained fever	N/A
Suspected typhoid fever	N/A
N/A	Others (leishmaniasis, typhoid fever, brucellosis, pertussis, tuberculosis)

(Syria Ministry of Health, 2017) (Assistance Coordination Unit, 2017a)

Table 32: Comparison to 2012 WHO guideline- Syria Early Warning and Response Network Assistance Coordination Unit (EWARN)

Case definitions	Provided in publication (Assistance Coordination Unit, 2017a)
Reason/objectives for set up	• Strengthen the capacity to conduct effective surveillance activities: train personnel at all levels; develop and carry out plans of action; and advocate and mobilize resources. • Integrate multiple surveillance systems so that resources can be used more efficiently. • Improve the use of information to: enable rapid detection, analysis and response to suspect epidemics and outbreaks; monitor the impact of interventions; and facilitate evidence-informed public health policy, planning and action. • Improve the flow of surveillance information across levels of the health system. • Strengthen laboratory capacity for pathogen detection and monitoring of drug resistance. • Increase involvement of clinicians in the surveillance system. • Emphasize community participation in detection and response to public health problems. • Trigger epidemiological investigations to detect and respond to public health threats.
Duration	2012 - current
Similarities	Includes: acute watery diarrhoea (suspected cholera), acute bloody diarrhoea (suspected shigellosis), acute flaccid paralysis (suspected poliomyelitis), acute jaundice syndrome, suspected measles, suspected meningitis,
Differences	Includes: severe acute respiratory illness (SARI)[27], suspected typhoid fever, cutaneous leishmaniasis. Event based- unexplained fever, unexplained death, and unusual cluster of health events. Excludes: acute haemorrhagic fever, confirmed malaria
Number of priority diseases/syndromes	12

[27] Syria EWARN ILI and SARI case definition Appendix 17

Table 33: Comparison to 2012 WHO guideline- Early Warning and Response System (EWARS), WHO Syria and Syria Ministry of Health

Case definitions	Not provided in publication (Syria Ministry of Health, 2017)
Duration	2012 - current
Reason/objectives for set up	To strengthen the national surveillance system, detect epidemic threats early, respond and control outbreaks and monitor epidemic-prone diseases.
Similarities	Includes: acute watery diarrhoea, bloody diarrhoea, acute flaccid paralysis, acute jaundice syndrome, suspected measles, suspected meningitis
Differences	Includes: acute diarrhoea, influenza like illness, severe acute respiratory illness (SARI), others (leishmaniasis, typhoid fever, brucellosis, pertussis, tuberculosis) Excludes: acute haemorrhagic fever, confirmed malaria
Number of priority diseases/syndromes	10

Yemen, 2012

According to the IDMC, Yemen has been in a state of political crisis since 2011, with secessionist groups fighting and taking control of parts of the country. In June 2012, conflict in the south of Yemen displaced more than 200,000 people. The situation was exacerbated further through the occurrence of natural disasters (famine and flood). The WHO and Ministry of Public Health and Population set up the Electronic Disease Early Warning System (eDEWS) to facilitate early warning of outbreaks of epidemic prone disease in this CHE setting. Ahmed (2013) briefly describes the implementation of the set up, including a list of priority diseases/syndromes (Box17). The conflict intensified in 2015, with an estimated 2.5 million people displaced by year-end (Internal

Displacement Monitoring Centre, 2016b). In response, eDEWS was scaled up to increase coverage throughout all governorates (WHO Regional Office for the Eastern Mediterranean, 2016).

Table 34: Comparison to 2012 WHO guideline - Yemen

Case definitions	Not provided in publication (K. Ahmed, 2013) (K. A. Ahmed, Mohammad Dauod; Dureab, Fekri, 2014)
Duration	2012 - current
Reason/objectives for set up	Minimize morbidity and mortality due to communicable disease through detection of outbreaks at their earliest possible stage
Similarities	Includes: acute watery diarrhoea, acute bloody diarrhoea, acute flaccid paralysis, measles, suspected meningitis, and pneumonia.
Differences	Includes: Other diarrhoea, upper respiratory tract infection, viral haemorrhagic fever, confirmed meningitis, acute viral hepatitis, leishmaniasis, confirmed dengue, schistosomiasis, pertussis, and neonatal tetanus. Excludes: acute jaundice syndrome (AJC), acute haemorrhagic fever, confirmed malaria
Number of priority diseases/syndromes	16

Discussion

The WHO (2012) guidelines on implementing EWARN recommend eight specific diseases/syndromes for inclusion in surveillance.[28] Yet out of twenty EWARN-like systems established from 1997-2017, only Pakistan (2005) and Somalia (2013) include all eight diseases/syndromes. It is concerning that three out of five systems established after the publication of the guidelines in 2012 did not include all recommended diseases/syndromes i.e. Fiji, Solomon Islands, and Yemen (Nigeria did not list all eight either but available information is not complete). Acute flaccid paralysis, used for early detection of poliomyelitis, was the most frequently omitted WHO (2012) guideline recommended diseases/syndrome.

According to the WHO, cases of poliomyelitis have decreased globally by over 99% since 1988 (World Health Organisation, 2017c). In 1988, there were approximately 350,000 people a year who were infected; in 2016, it was 37. This dramatic reduction is due to the launch of the Global Polio Eradication Initiative (GPEI) after a resolution to eradicate polio by the Forty-first World Health Assembly in 1988. The mission of GPEI is to 'complete the eradication and containment of all wild, vaccine-related and Sabin polioviruses, such that no child ever again suffers paralytic poliomyelitis' (Global Polio Eradication Initiative, 2017). Today more than 80% of the world's population lives in a designated polio free area. The WHO Region of the Americas was the first to be

[28] Acute watery diarrhoea, acute bloody diarrhoea, acute flaccid paralysis, acute jaundice syndrome, acute haemorrhagic fever, suspected measles, suspected meningitis, and confirmed malaria

declared polio free (1994), followed by the Western Pacific (2000), Europe (2002), and South East Asia in 2014 (World Health Organisation, 2017c).

The following are EWARN-like systems that excluded acute flaccid paralysis/suspected poliomyelitis matched to the polio status of the region:

- China, Fiji (2016), Solomon Islands (2013): Western Pacific certified polio free in the year 2000
- Albania (2000) and Serbia (2002): European region certified polio free in 2002
- Indonesia (2004), and Myanmar (2008): South East Asia was certified polio free in 2014. And Indonesia's last case of poliomyelitis was in 1995.

The fact that poliomyelitis has been eradicated from so much of the world supports excluding acute flaccid paralysis as a priority disease/syndrome in EWARN. At least in countries or regions that have been polio free for years and even decades.

Only three countries have never stopped transmission of polio: Pakistan, Afghanistan and Nigeria (WHO regions Eastern Mediterranean and Africa). Consequently, both Pakistan systems and Nigeria include acute flaccid paralysis in EWARN.

However, during emergencies and disasters, disruption or destruction of medical infrastructure and loss of medical personnel negatively impact routine services

like vaccination programs. The result is a resurgence of polio, or other vaccine preventable disease, in a previously polio free country/region. The situation is worsened if the emergency or disaster persists over a long period of time; such as often happens in CHEs.

This breakdown of health systems as seen in Syria, resulted in an outbreak of polio in July 2013; while, Syria had been certified polio free from 1999 (World Health Organisation, 2017d).

Iraq (2003) also did not include acute flaccid paralysis (AFP), and it was polio free since the year 2000. Nevertheless, in 2014, there were two cases of poliomyelitis diagnosed with connection to the 2013 Syrian outbreak. This serves to demonstrate that the decision to exclude AFP, or another vaccine preventable disease (even in country or region declared free of the disease) must be considered carefully; taking into account the short and long term impact of the emergency/disaster on health systems.

Context is also important when investigating why certain WHO (2012) guidelines diseases/syndromes were excluded from some EWARN-like systems. This was partly discussed in relation to endemicity of a disease (i.e. poliomyelitis). The second part is to consider existing surveillance systems that may be functioning and running in parallel to EWARN. For example, Fiji (2016) excludes AFP from EWARS in a box. And the stated objective of Fiji EWARS was to:

- Supplement existing systems to ensure the MOHMS was able to adequately monitor burden of communicable diseases and detect potential outbreaks in a timely fashion.

Existing systems in Fiji include hospital based active surveillance (HBAS), which includes monitoring for cases of acute flaccid paralysis (suspected poliomyelitis); a WHO 2012 guideline recommended disease/syndrome left out of Fiji EWARS. Fiji also has childhood vaccination coverage of approximately 95%, and decades have passed since the last poliomyelitis case was diagnosed.

The guidelines also clearly recommend that certain disease/syndromes are not included in EWARN. [29] However, sixteen of the twenty EWARN-like systems include at least one of these diseases/syndromes, with acute respiratory infections being the most common (n=10); although case definitions were not available for some of these (n=5). It is notable that four of the six systems established after 2012 included at least one of these not recommended diseases/syndromes.[30]

The context of the emergency/disaster is again important to review. As an example, the WHO 2012 guidelines specifically state that only confirmed malaria should be included as a priority disease for EWARN because the case definition

[29] Other diarrhoeal disease (not suspected cholera or shigellosis), acute respiratory infection (not specific to lower respiratory tract infection or pneumonia), upper respiratory tract infection, suspected malaria, and malnutrition.

[30] Fiji, Nigeria, Solomon Islands, and Yemen

for suspected malaria has a poor positive predictive value[31]. However, Haiti (2010) includes both confirmed and suspected malaria as priority diseases. Severe destruction caused by the earthquake would also have delayed laboratory testing of blood samples needed to confirm a case of malaria. This may still occur in the age of rapid diagnostic tests (RDTs) in the immediate aftermath of a severe emergency/disaster. Therefore, including a 'suspected' case definition would enable a clinician to potentially diagnose, treat, and report in a timely manner, while awaiting test results to 'confirm' the suspected case.

The guidelines also emphasize that only epidemic prone diseases should be prioritized for surveillance. It is evident from the findings of this review that this recommendation is sometimes not followed, because disease/syndromes that are of public health importance (but not epidemic prone) have been included, e.g., non-communicable disease (NCDs) such as asthma attacks in Philippines (2009). Increasing the number of diseases/syndromes under surveillance may affect data quality, and also contradicts the primary objective of EWARN (according to the guidelines) i.e. "to rapidly detect and respond to signals that might indicate outbreaks and clusters of epidemic-prone diseases."(WHO, 2012)

Therefore, it is important to consider the primary objectives of each EWARN-like system when attempting to explain incongruity with the 2012 guidelines. For example, in Philippines (2009) the objectives of SPEED include:

[31] Positive predictive value: proportion of cases reported by the test (here is a case definition) that are true cases

- Early detection of unusual increases or occurrences in communicable and non- communicable diseases/health conditions
- Monitor health trends

It is evident the inclusion of NCDs in the objectives for SPEED differs from the WHO (2012) guidelines, and explains why NCDs are included for surveillance in this system. NCDs are undoubtedly of public health importance, though they are certainly not epidemic prone diseases. However, the people displaced during an emergency or disaster are being displaced with their pre existing conditions, including NCDs. Exacerbating the situation also is the possibility that in fleeing to safety, people may be without regular medications and/or chronic conditions (e.g. asthma) could be worsened due to injury or deprivation. This puts more pressure on the healthcare available, and not monitoring these diseases could result in underestimation of resources, and delayed care; impacting morbidity and mortality in the long term. This was highlighted during a morbidity survey after Hurricane Katrina in 2005, where the most commonly reported category in evacuation centres (accounting for 33% of patient visits) was chronic disease (diabetes, asthma, emphysema, and cardiovascular disease)(MMWR, 2006)

However, EWARN is not best suited for estimating the burden of NCDs in a displaced population. The reasoning for this is comparable to the explanations offered by the WHO 2012 guidelines for not recommending the inclusion of malnutrition in EWARN.

- EWARN requires only one major diagnosis. This is necessary to support ease of use, and maximise data quality. However, people with chronic

conditions like NCDs may present with other acute diseases (e.g. communicable diseases) and these will more likely be recorded instead.

- EWARN is designed to monitor trends in acute illness, new cases of disease, i.e., incidence. For NCDs, this could mean that only cases that present in crisis (acute exacerbation of asthma, myocardial infarction etc.) will be reported. If this is the only method of assessing NCD burden in a displaced population, then there is risk of underestimation.

Systems that determine prevalence are better suited to estimate burden of NCDs and guide resource allocation for management in displaced populations. Sources for this data could include:

- Primary sources e.g. registries at IDP/refugee camps
- Secondary sources e.g. district, town, or national data NCD registries, pharmacy records

Also, a key component of early warning in EWARN is response. For outbreak prone diseases, early warning could be critical to mitigating impact of an outbreak and hasten control measures to prevent spread, e.g., isolation and vaccination during a suspected measles outbreak. For chronic disease, response will be in the form of directing resources (medical personnel, consumables, medications, etc.) The 'non-communicable' feature of these diseases mean that early warning and rapid response to contain spread to the previously well or particularly vulnerable (e.g. young children) does not apply.

The key objective for EWARN, as described by WHO (2012) guidelines, is early warning of epidemic prone disease. Deviation from specific recommendations,

particularly increasing disease reporting requirements, risks the efficacy of EWARN as an early warning system. However, as discussed, the reality is that early warning surveillance for epidemic prone disease is just one of many other healthcare priorities for displaced populations during emergencies or disasters. Also, running many surveillance systems in parallel may be wasteful when resources are scarce.

Although the early warning alert function of EWARN must not be compromised, there may be room to investigate integration of surveillance functions across diseases/syndromes/health events of public health importance. This may be especially needed in situations where displacement will be potentially longstanding.

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Appendices

Appendix 1

Diseases and medical conditions encountered in disaster situations WHO (1994)

Disease/medical condition	Population displacement	Epidemic	Earthquake/volcanic eruption	Flood/tidal wave	Drought	War	Environment pollution
Aids/HIV	1	0	0	0	0	1	0
Anaemia	2	0	0	0	1	0	1
Anthrax	1	1	0	1	0	0	1
Cholera	2	2	0	2	1	1	1
Dehydration	1	0	1	0	1	1	0
Dengue*	1	1	0	1	0	0	0
Diphtheria	1	1	0	0	0	0	0
Dysentery/gastroenteritis	2	2	0	2	1	1	1
Enteric fevers	2	2	0	1	1	1	1
Haemorrhagic fever*	1	1	0	1	0	1	0
Hepatitis A	1	1	2	2	1	1	1*
Intoxication	0	1	0	0	0	0	2
Leptospirosis	1	1	0	1	0	1	2
Leishmaniasis	1	1	0	0	1		
Malaria	2	2	0	1	1	1	0
Malnutrition	2	0	0	0	1	1	0
Measles	2	1	1	1	2	1	0
Meningitis	1	2	0	0	0	1	0
Plague*	2	1	0	0	0	1	0
Poliomyelitis	1	1	0	1	0	0	1
Protozoan dysentery	1	1	0	1	1	1	1
Relapsing fever*	2	2	0	0	0	1	0
Streptococcal disease	0	1	2	0	0	0	0
Tetanus	1	0	2	1	0	2	0
Trauma	1	0	2	2	0	2	0
Tuberculosis	1	1	0	0	0	0	0
Typhus*	1	1	0	0	1	1	0
Viral encephalitis	1	0	0	1	0	0	0
Whooping cough	1	0					

0= Rare problem 1 = Potential problem (depends on area) 2 = Likely problem (depends on area)
*Particularly in endemic areas

World Health Organisation. (1994). *Health Laboratory Facilities in Emergencies and Disaster Situations* (ISBN 92–9021–182–2). Retrieved from https://www.mona.uwi.edu/cardin/virtual_library/docs/1244/1244.pdf

Appendix 2

Communicable disease risk assessment in humanitarian emergency settings WHO (2007)

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.[1]

- ***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.

World Health Organisation. (2007). *Communicable Disease Risk Assessment: Protocols for Humanitarian Emergencies*. Retrieved from http://www.who.int/diseasecontrol_emergencies/guidelines/Com_dis_risk_ass_oct07.pdf

Appendix 3

Case Definitions: EWARN Darfur (2003)

Table (1): Case definitions and alert status for health events.

Health event	Definition	Alert status
Acute watery diarrhoea (AWD)	Acute watery diarrhoea with severe dehydration in a patient older than five years of age.	Fever (>38°C) for more than 48 hours and not meeting the above case definitions.
Diarrhoea with blood (Dysentery)	More than 3 loose stools per day (24 hours) with visible blood.	
Acute respiratory infection (ARI)	Fever and at least one of the following: rhinitis, cough, redness or soreness of throat OR Fever and fast breath (>50 breaths /min) and at least one of the following: Cough, difficulty in breathing.	
Suspected measles	Rash with fever and cough, runny nose, or conjunctivitis.	
Acute jaundice syndrome	Acute onset of yellow eyes or skin	
Suspected meningitis	12 months and over: Sudden onset of fever (>38°C) with stiff neck. Under 12 months: Fever with bulging fontanel.	
Acute Flaccid Paralysis (AFP)	Acute flaccid paralysis in a child aged <15 years, including Guillain-Barre syndrome OR any acute paralytic illness in a person of any age.	
Malaria	*Suspected case:* Person with fever or history of fever within last 48 hours associated with symptoms such as nausea, vomiting, and diarrhoea, headache, back pain, chills, myalgia, where other obvious causes of fever have been excluded. *Confirmed case:* Demonstration of malaria parasites in blood films by examining thick or thin smears or by rapid diagnostic test for P. Falciparum.	
Neonatal tetanus	*Suspected case:* Any neonatal death between 3 and 28 days of age in which the cause of death is unknown or any neon- ate reported as having suffered from neonatal tetanus between 3 and 28 days of age and not investigated. *Confirmed case:* Any neonate with a normal ability to suck and cry during the first two days of life and who between 3 and 28 days of age cannot suck normally and becomes stiff or has convulsions or both.	
Injuries	Any person with traumas or wounds from any cause that require surgical treatment and hospitalisation.	
Severe malnutrition	Malnutrition: In children 6 to 59 months (65cm to 110cm in height): <70% Weight for height (W/H) index OR <-3z scores (on table of NCHS/WHO normalized reference values of weight-for-height by sex) OR MUAC <11cm Bilateral pitting oedema irrespective of W/H, in absence of other causes.	
Unexplained fever		

	significance or Outbreak alert	Outbreak alert
Outbreak alert		
Outbreak alert	Condition of public health significance or Outbreak alert	
Condition of public health significance	Outbreak alert	
		Condition of public health significance
	Condition of public health significance or Outbreak alert	
Outbreak alert		Condition of public health significance
Condition of public health		
Others	All others medical conditions not meeting the above case health definitions	Condition of public significance

"Outbreak alerts" necessitated immediate reporting to the MoH and/or WHO, usually by telephone. "Conditions of public health significance" were reportable weekly. Meningitis and malaria were reported as "conditions of public health significance" or "outbreak alerts" depending on the season.

Morof D.F. , Abou-Zeid A., & Brennan M. . (2013). An Evaluation of an Early Warning Alert and Response Network (EWARN) in Darfur, Sudan *Medical Journal of Cairo University, 81*(2).

Appendix 4

Priority diseases/syndromes: Pakistan DEWS 2005

Table 1. The set diagnostic thresholds for alerts and outbreaks relevant to the disease entities incorporated in the disease early warning system (DEWS) surveillance network

Disease/condition	Thresholds	
	Alerts	Outbreaks
Acute lower respiratory infection	Twice the average number of cases of the previous three weeks for a given location	Clustering of cases in a single location above the alert threshold
Acute upper respiratory infection	Twice the average number of cases of the previous three weeks for a given location	Not specified until infectious agent is identified
Acute diarrhoea (non cholera)	Twice the average number of cases of the previous three weeks for a given location	Clustering of cases in a single location above the alert threshold
Acute watery diarrhoea (suspected cholera)	One suspected case	A confirmed case, or a cluster of three or more suspected cases in a single locality
Bloody diarrhoea	Three or more cases in one location	Doubling of case-load from alert threshold in one location
Haemorrhagic fever	One probable case	One confirmed case
Acute jaundice syndrome	Three or more cases in one location	A cluster of 8–10 cases in one location
Malaria	Twice the average number of cases of the previous three weeks for a given location	Clustering of cases in a single location above the alert threshold
Measles	One case	Five or more cases in a single location
Meningococcal meningitis	One case	Two or more confirmed cases from a single location
Acute flaccid paralysis	One suspected case	One confirmed case
Unexplained fever	One death or twice the average number of cases of the previous three weeks for a given location	Not specified until infectious agent is identified
Neonatal tetanus	One case requires investigation for safe birth practices	None (does not spread)
Scabies	Twice the average number of cases of the previous three weeks for a given location	To be determined by trends (recently added to surveillance)

Rahim, M., Kazi, B. M., Bile, K. M., Munir, M., & Khan, A. R. (2010). The impact of the disease early warning system in responding to natural disasters and conflict crises in Pakistan. *East Mediterr Health J, 16 Suppl*, S114-121.

Appendix 5

Case definitions: Pakistan DEWS 2010

TABLE 2. Disease Early Warning System priority conditions, alert criteria, number of cases, and disease alerts — Pakistan, July 29– September 15, 2010*

Disease	Case definition	Alert criteria	Action suggested	Total visits (N = 5,618,902) No.	(%)	Disease alerts (N = 130) No.	(%)
Diseases requiring notification and investigation							
Acute watery diarrhea (suspected cholera)	In an area where cholera is not known to be present: A person aged >5 years with severe dehydration or death from acute watery diarrhea with or without vomiting In an area where there is a cholera outbreak: A person aged >5 years with acute watery diarrhea with or without vomiting *To confirm a case of cholera*: Isolation of *Vibrio cholerae* O1 or O139 from a stool sample	One suspected case	Reinforce appropriate case management; initiate investigation	745.532†	(13.3%)	115	(88.5%)
Bloody diarrhea	Acute diarrhea with visible blood in the stool *To confirm a case of epidemic bacillary dysentery*: Take a stool specimen for culture and blood for serology; isolation of *Shigella dysenteriae* type 1	Three or more cases in one location	Reinforce appropriate case management, including antibiotic usage; collect stool for culture and antimicrobial sensitivity; initiate investigation	49,304	(0.9%)	1	(0.8%)
Acute respiratory infection	Cough or difficulty breathing and breathing 50 or more times per minute for infants aged 2 months to 1 year / breathing ≥40 or more times per minute for children aged 1–5 years, and no chest indrawing, no stridor, no general danger signs§ *Note*: Severe pneumonia = cough or difficulty breathing and one or more of the following (inability to drink or breastfeed, severe vomiting, convulsions, lethargy or unconsciousness) or chest indrawing or stridor in an otherwise calm child	Twice the average number of cases seen in the previous 3 weeks for a given location	Reinforce appropriate case management; initiate investigation	850,292	(15.1%)	0	—
Suspected malaria	Current fever or history of fever within the past 48 hours (with or without other symptoms such as nausea, vomiting and diarrhea, headache, back pain, chills, muscle pain) *To confirm a case of malaria*: Positive laboratory test for malaria parasites (blood film [thick or thin smear] or rapid diagnostic test) *Uncomplicated malaria*: Fever and no general danger signs such as lethargy or unconsciousness, convulsions, or inability to eat or drink. Where possible confirm malaria with laboratory test *Severe malaria*: Fever and general danger signs (lethargy or unconsciousness, convulsions, or inability to eat or drink)	Twice the mean number of cases seen in the previous 3 weeks for a given location	Active fever finding and specimen collection for laboratory confirmation	201,525	(3.6%)	1	(0.8%)
Suspected measles	Fever and maculopapular rash (i.e., nonvesicular) and cough, coryza (i.e., runny nose) or conjunctivitis (i.e., red eyes) or any person in whom a clinical health worker suspects measles infection *To confirm a case of measles*: Presence of measles-specific immunoglobulin M	One case	Immediate investigation and active case finding in coordination with the national immunization program	60	(<0.1%)	7	(5.4%)

TABLE 2. (*Continued*) Disease Early Warning System priority conditions, alert criteria, number of cases, and disease alerts — Pakistan, July 29–September 15, 2010*

Disease	Case definition	Alert criteria	Action suggested	Total visits (N = 5,618,902) No.	(%)	Disease alerts (N = 130) No.	(%)
Diseases requiring notification and investigation							
Suspected meningitis	Sudden onset of fever (>101.3°F [>38.5°C]) with stiff neck. In patients aged <12 months, a suspected case of meningitis occurs when fever is accompanied by a bulging fontanelle *Probable case of bacterial meningitis*: Suspected case of acute meningitis, as defined above, with turbid cerebrospinal fluid (CSF) *Probable case of meningococcal meningitis*: Suspected case of acute meningitis, as defined above, and Gram stain showing gram-negative diplococcus or ongoing epidemic or petechial or purpural rash *To confirm a case of meningococcal meningitis*: Suspected case, as defined above, with either positive-CSF antigen detection for *Neisseria meningitidis* or positive CSF or blood culture with identification of *N. meningitidis*	One case	Reinforce appropriate case management; initiate investigation	4	(<0.1%)	2	(1.5%)
Acute flaccid paralysis (suspected poliomyelitis)	Acute flaccid paralysis in a child aged <15 years, including Guillain-Barre syndrome, or any acute paralytic illness in a person of any age in whom poliomyelitis is suspected	One suspected case	Case investigation and specimen collection for laboratory diagnosis	9	(<0.1%)	2	(1.5%)
Acute hemorrhagic fever syndrome	Acute onset of fever (duration of <3 weeks) and any of the following: hemorrhagic or purpuric rash, vomiting with blood, cough with blood, blood in stools, epistaxis, other hemorrhagic symptoms		Initiate verification and investigation as required	0		1	(0.8%)
Acute jaundice syndrome	Illness with acute onset of jaundice and absence of any known precipitating factors and/or fever	Three of more cases in one location	Initiate verification and investigation as required. Specimen collection for laboratory confirmation	189	(<0.1%)	0	—
Unexplained fever	Fever (body temperature >101.3°F [>38.5°C]) for >48 hours and without other known etiology	One death or two times the mean number of cases of the previous 3 weeks for a given location	Initiate investigation	327,453	(5.8%)	0	—
Unknown disease occurring in cluster	An aggregation of cases with similar symptoms and signs of unknown cause that are closely grouped in time and/or place	An aggregation of cases with related symptoms and signs of unknown cause that are closely grouped in time and/or place	Initiate verification and investigation as required	0		0	—

TABLE 2. (*Continued*) Disease Early Warning System priority conditions, alert criteria, number of cases, and disease alerts — Pakistan, July 29–September 15, 2010*

Disease	Case definition	Alert criteria	Action suggested	Total visits (N = 5,618,902) No.	(%)	Disease alerts (N = 130) No.	(%)
Other diseases of public health importance							
Other diarrhea	Acute diarrhea (passage of three or more loose stools in the past 24 hours) with or without dehydration, and which is not because of bloody or watery diarrhea			745,532†	(13.3%)	—	—
Other diseases	Including skin diseases, dog bites, snake bites, eye and ear infections, injuries, heat stroke, and other diseases			3,444,534	(61.3%)	1	(0.8%)¶

* Source: Outbreak surveillance and response, disease early warning system, flooding response in Pakistan, operational guidance, August 2010. Available at http://www.who.int/hac/crises/pak/pakistan_operational_guidance_flooding_august2010.pdf.

† Diarrhea was reported as acute diarrhea, which included acute watery diarrhea and other diarrhea.

§ Not specified. ¶ Leishmaniasis.

Sabatinelli G, Rene Kakar S., Khan M.R., Malik M., Kazi B.M. , Aurakzai J.K. , . . . Shahpar C. (2012).

Early Warning Disease Surveillance After a Flood Emergency — Pakistan, 2010

Appendix 6

Case definitions: Fiji EWARS in a box (2016)

Syndrome	Case definition	Thresholds
Acute fever and rash	Fever either reported or measured (>38°C) PLUS non-blistering rash	1 case
Prolonged fever	Any fever either reported or measured (>38°C) lasting three or more days	Twice the average number of cases seen in the previous 2 weeks
Influenza-like illness	Fever either reported or measured (>38°C) PLUS cough and/or sore throat.	Twice the average number of cases seen in the previous 2 weeks
Acute watery diarrhoea	Three or more loose or watery stools in 24hrs (non-bloody).	Twice the average number of cases seen in the previous 2 weeks
Acute bloody diarrhoea	Any episode of acute bloody diarrhoea	3 cases in one location in 1 week or twice the average number of cases seen in the previous 2 weeks
Acute jaundice syndrome	Jaundice (yellow eyes or dark urine) AND severe illness with or without fever.	3 cases
Suspected dengue	Fever for at least 2 days PLUS at least two of the following:- nausea or vomiting; - muscle or joint pain; - severe headache or pain behind the eyes; - rash; - bleeding.	Twice the average number of cases seen in the previous 3 weeks
Suspected meningitis	Sudden onset of fever, PLUS one or more of the following:- severe headache;- neck stiffness;- altered consciousness; - petechial/puerperal rash.	1 case
Zika-like illness	Generalized maculopapular rash plus two or more of the following: Arthralgia or myalgia; Red eyes or non-purulent conjunctivitis; Oedema of hands or feet; Low grade fever (< 38℃), Pain behind the eyes	3 cases

Appendix 7.0

Priority diseases/syndromes: Somalia CSR (2013)

Table 1: Priority Diseases/Conditions under Surveillance

Weekly Surveillance	
Suspected Cholera	Suspected Diphtheria
Suspected Shigellosis (Dysentery)	Suspected Whooping Cough (Pertussis)
Suspected Measles	Confirmed Malaria
Acute Flaccid Paralysis	Neonatal Tetanus
Additional Conditions for Immediate Reporting Only	
Suspected Meningitis	Severe Acute Respiratory Infection (SARI)
Acute Jaundice Syndrome	Rumour of unusual cluster of deaths
Suspected Haemorrhagic Fever[1]	Rumour of unusual cluster of health events

[1] 2013 Revision: Moved from weekly surveillance to immediate reporting due to zero cases reported in 2012 and the need for immediate notification if case(s) appear.

WHO Somalia. (2013). Roles and responsibilities for surveillance staff in Somalia Communicable Diseases Surveillance and Response A Field Manual, v2, 2013. pp.5

Appendix 7.1

Case Definitions: Somalia CSR (2013)

Suspected or Confirmed Diseases	Case Definition
Suspected cholera	- Person aged 5 years or more with severe dehydration OR death from 3 or more acute watery diarrhea per day (24 hours), with or without vomiting - Child aged 2-4 years with severe dehydration OR death from acute watery diarrhea, with or without vomiting
Suspected shigellosis (dysentery)	- Person with 3 or more loose stools (diarrhea) per day (24 hours) with visible blood OR any person in whom a clinician suspects shigellosis (NOT just bloody diarrhea)
Suspected measles	- Person with fever AND generalized, spotty (maculopapular, non-vesicular) rash AND ONE of the following: cough, runny nose (coryza) or red eyes (conjunctivitis) OR any person in whom a clinician suspects measles
Acute flaccid paralysis	- Child younger than 15 (14 or less) with acute sudden of weakness or inability to move an arm or leg (flaccid paralysis) OR any person in whom a clinician suspects polio
Suspected diphtheria	- Person with hoarse or complete loss of voice (laryngitis) or sore throat (pharyngitis or tonsillitis) AND non-removable coating (adherent membrane) of back of throat (tonsils or pharynx), and/or nose
Suspected whooping cough (pertussis)	- Person with cough lasting at least 2 weeks AND ONE of the following signs: o Fits of coughing (paroxysms) o Making whooping sound when breaking in (inspiratory whooping) o Vomiting immediately after coughing without other cause (post-tussive vomiting)
Confirmed malaria	- Person with fever or history of fever (>38.0^{0}C) in last 48 hours and/or other symptoms AND positive laboratory confirmation by microscopy or rapid diagnostic test
Neonatal tetanus	- Neonate aged 3 to 28 days with normal sucking and crying for first 2 days of life AND now cannot suck normally OR becomes stiff with jerking of muscles

Cordes, K. (2013). *Communicable Disease Surveillance in Somalia, 2012.* (Master of Public Health), Rollins School of Public Health of Emory University. Emory Electronic Theses and Dissertations (ETD) Repository database.

Appendix 8

Case Definitions: Syria (EWARN-ACU)

Disease	CODE	DEFINITION	THRESHOLD
1. Acute bloody diarrhoea (suspected shigellosis)	ABD	Acute diarrhoea (three or more abnormally loose or fluid stools in the past 24 hours) with visible blood in stool (preferably observed by the clinician).	≥ 5 cases in 1 location in 1 week or double the weekly average*
2. Acute watery diarrhoea (suspected cholera)	AWD	Age five years or older with sudden onset of acute watery diarrhoea with severe dehydration or death with or without vomiting.	1 case
3. Acute jaundice syndrome	AJS	Acute onset of jaundice (yellowing of sclera of eyes or skin or dark urine), AND Severe illness with or without fever ≥ 38°C, AND; The absence of any known precipitating factors.	≥ 5 cases in 1 location in 1 week or double the weekly average*
4. Severe acute respiratory illness	SARI	Acute respiratory illness onset within the last 7 days with • History of fever or measured fever (≥ 38°C) • Cough • Requires hospitalization (whether possible or not)	≥ 5 cases in the same week in the same location or double the weekly average OR 1 death
5. Acute flaccid paralysis (suspected poliomyelitis)	AFP	Any child < 15 years with acute flaccid paralysis, OR; Any paralytic illness in a person of any age if poliomyelitis is suspected (NOT traumatic paralysis).	1 case
6. Suspected measles	MEA	Any person with fever ≥ 38°C, AND; maculopapular (nonvesicular) generalized rash, AND ONE of the following Cough, runny nose (coryza) or red eyes (conjunctivitis), OR; Any person in whom a clinician suspects measles.	1 case
7.Suspected meningitis	MEN	Any person with sudden onset of fever ≥ 38°C, AND ONE of the following signs: • Neck stiffness. • A bulging fontanel (in a child < 1 year). • Difficulty in suckling and irritation (in an infant < 2 months). • Altered consciousness. • Petechial or purpural rash. • Fatigue or lethargy. • Convulsions: - < 6 months- > 6 years: any convulsion crises (seizure). - 6 months to 6 years: any long and	1 case in a crowded camp setting Population ≥30,000: 5 cases per week/100,000 population Population

		localized convulsion crises or two or more generalized convulsion crisis during 24 hours.	<30,000: 2 cases per week
8a. Unusual cluster of health events	UCE	Any emerging disease or event of an unknown cause that is of public health concern or any communicable disease with an increased number from the expected particularly if clustered (cases that are closely grouped in time and/or place: several cases from the same family, school or workplace).	1 cluster
8b. Unexplained death	UED	Any deaths due to unknown or unidentifiable causes	1 case
8c. Unexplained fever	FUO	fever ≥ 38°C for > 48 hours AND without known etiology	≥ 5 cases in 1 location in 1 week or double the weekly average*
9.Suspected Typhoid fever	STF	fever ≥ 38°C > days with (headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and nonproductive cough) or symptomatic case contacted with confirmed case	≥ 5 cases in 1 location in 1 week or double the weekly average*
10.Leishmaniasis	LEISH	A person showing clinical signs (skin lesions). A papule appears, which may enlarge to become an indolent ulcerated nodule or plaque. The sore remains in this stage for a variable time before self healing and typically leaves a depressed scar. Other atypical forms may occur.	>50 new cases in one area or health facility.

Assistance Coordination Unit (Assistance Coordination Unit (ACU)). (2014). Early Warning Alert and Response Network. Retrieved from http://www.acu-sy.org/en/early-warning-alert-and-response-network/

Appendix 9

Case definitions: IDPSS Haiti (2010)

TABLE. Number of reported cases of 19 priority conditions monitored by the Internally Displaced Persons Surveillance System (IDPSS) — Haiti, February 2–April 24, 2010*

Priority condition	Case definition†	No. of reported cases (N = 23,183)	% of total clinic visits (N = 96,472)
Requiring immediate notification of the Haiti Ministry of Public Health and Population			
Acute hemorrhagic fever syndrome	Acute onset of fever of less than 3 weeks' duration in a severely ill patient and any two of the following: hemorrhagic or purpuric rash, epistaxis, hematemesis, hemoptysis, blood in stools, other hemorrhagic symptom with no known predisposing host factors for hemorrhagic manifestations	183	0.2
Suspected measles	Fever **and** maculopapular rash (i.e., nonvesicular) **and** one of the following: cough, coryza, conjunctivitis **or** any person in whom a clinical health-care worker suspects measles infection	42	0.04
Suspected rabies	A person who has had close contact (usually a bite or a scratch) with a rabies-susceptible animal (e.g., dog, cat, bat, or mongoose) or an animal displaying clinical signs consistent with rabies (e.g., aggression/unprovoked bite, unusual behavior, excessive salivation) at the time of exposure, or within 10 days after exposure	14	0.01
Suspected meningococcal meningitis	Sudden onset fever (≥100.4°F [≥38.0°C] axillary) and one of the following signs: neck stiffness, altered consciousness, other meningeal signs or petechial/purpural rash In patients aged <1 year, meningitis is suspected when fever is accompanied by bulging of the fontanelle	4	0.004
Acute flaccid paralysis	Acute flaccid paralysis in a child aged <15 years, including Guillain-Barré syndrome or any paralytic illness in a person of any age	1	0.001
Suspected diphtheria	Laryngitis or pharyngitis or tonsillitis and adherent membrane of the tonsils, pharynx, and/or nares	1	0.001
Other reportable infectious diseases			
Acute respiratory infection	Fever ≥100.4°F (≥38ºC) and at least one of the following: rhinitis, cough, redness or soreness of throat **or** fever and fast breath and at least one of the following: cough or difficulty breathing Respiratory distress in children aged <5 years: breathing 50 or more times per minute for infants aged 2 months–1 year; breathing 40 or more times per minute for children aged 1–5 years; or severe respiratory distress in a child might be signalled by an inability to drink or breastfeed, persistent vomiting, convulsions, lethargy, or chest indrawing or stridor in a calm child	8,878	9.0
Suspected malaria	*Uncomplicated malaria* Fever ≥100.4°F (≥38.0°C) or history of fever within the past 48 hours (with or without other symptoms, such as nausea, vomiting and diarrhea, headache, back pain, chills, and myalgia) in persons for whom other obvious causes of fever have been excluded *Severe malaria* Symptoms as for uncomplicated malaria, plus drowsiness with extreme weakness and associated signs and symptoms related to organ failure, such as disorientation, loss of consciousness, convulsions, severe anaemia, jaundice, haemoglobinuria, spontaneous bleeding, pulmonary edema, and shock	4,899	5.0
Watery diarrhea	Acute diarrhea (three or more abnormally loose or fluid stools in the past 24 hours) with or without dehydration	4,549	5.0
Fever of unknown cause	Person with fever ≥100.4°F (≥38°C) in whom all obvious causes of fever have been excluded; this would include suspected cases of dengue fever	2,938	3.0
Suspected typhoid	A patient with fever ≥100.4°F (≥38°C) that has lasted for at least 3 days **and** two of the following: headache, anorexia, abdominal pain, constipation, diarrhea, vomiting **and** other obvious causes of fever have been excluded; for example, malaria should be ruled out (by high clinical suspicion, rapid diagnostic test, or microscopy) before giving a diagnosis of suspected typhoid fever	753	0.8

TABLE. (*Continued*) Number of reported cases of 19 priority conditions monitored by the Internally Displaced Persons Surveillance System (IDPSS) — Haiti, February 2–April 24, 2010*

Priority condition	Case definition†	No. of reported cases (N = 23,183)	% of total clinic visits (N = 96,472)
Bloody diarrhea	Acute diarrhea with visible blood in the stool	497	0.5
Acute febrile illness with jaundice	Acute onset of jaundice **and** fever ≥100.4°F (≥38°C) with the absence of any known precipitating factors	110	0.1
Tetanus	In an adult with a wound history or a visible infection entry point: jaw contracture with impossibility to eat and to talk, painful muscular contractions, generalized muscle spasms, rigidity In a neonate: any neonate with normal ability to suck and cry during the first 2 days of life who from 3 and 28 days of age cannot suck normally and becomes stiff or has convulsions	18	0.02
Suspected whooping cough	Cough for >2 weeks and at least one of the following symptoms: paroxysms (i.e., fits) of coughing, inspiratory whooping, posttussive vomiting (i.e., vomiting immediately after coughing) without other apparent cause	13	0.01
Suspected cutaneous anthrax	Skin lesion evolving over 1–6 days: papular through vesicular stage, to depressed black eschar invariably accompanied by edema that might be mild or extensive	0	—
Programmatic indicators			
Tuberculosis (TB) patient with interrupted treatment	Any patient who has active TB and is currently out of care or experiencing an interruption in TB treatment	57	0.06
HIV/AIDS§ patient with interrupted antiretroviral therapy (ART)	Any HIV-infected patient who states that he or she has experienced an interruption in HIV care or ART	16	0.02
Third trimester pregnancy without previous or pregnancy complications	Pregnant woman in the third trimester without any previous antenatal care and/or a pregnant woman at any trimester with a complication such as premature rupture of membranes, preeclampsia, eclampsia, bleeding, infection, and complicated abortion	210	0.2

* Although the official launching of the IDPSS was February 18, 2010, several nongovernment organizations were submitting reports before that date.

† Haiti Ministry of Public Health and Population and World Health Organization case definitions were adapted to reflect syndromic diagnoses.

§ Human immunodeficiency virus/acquired immunodeficiency syndrome.

Magloire R., Cookson ST. , Tappero J, Barzilay E., Dominguez K., Dubray C., . . . Walldorf J.A. (2010). Rapid establishment of an internally displaced persons disease surveillance system after an earthquake --- Haiti, 2010. *MMWR: Morbidity and Mortality Weekly Report, 59*(30), 939-945.

Appendix 10

Priority diseases/syndromes: Philippines SPEED (2009)

#	Disease Syndrome	Initial Diagnoses
1	Fever	Fever
2	Cough, colds or sore throat with or without fever	Acute Respiratory Infection
3	Fever with rash	Suspected Measles
4	Fever with spontaneous bleeding	Acute Hemorrhagic Fever
5	Fever with severe headache and stiff neck in children 12 months and older/ Fever and bulging fontanels or refusal to suckle in children <12 months	Suspected Meningitis
6	Fever with headache, muscle pains and any of the following: eye irritation, jaundice, skin rash, scanty urination	Suspected Leptospirosis
7	Yellow eyes or skin with or without fever	Acute Jaundice Syndrome
8	Fever with other symptoms not listed above	Fever with Other Symptoms not specified above
9	Loose stools, 3 or more in the past 24 hours with or without dehydration	Acute Watery Diarrhea
10	Loose stools with visible blood	Acute Bloody Diarrhea
11	Open wounds and bruises/burns	Open Wounds & Bruises/Burns
12	Fractures	Fractures
13	Skin disease	Skin Diseases
14	Animal bites	Animal Bites
15	Eye itchiness, redness with or without discharge	Conjunctivitis
16	Spasms of neck and jaw (lock jaw)	Tetanus
17	High blood pressure (≥ 140/90)	High Blood Pressure
18	Known diabetes	Known Diabetes Mellitus
19	Difficulty of breathing and wheezing	Acute Asthmatic Attack
20	Floppy paralysis of the limbs which occurred recently in a child <15 years who is previously normal	Acute Flaccid Paralysis
21	Visible wasting, with or without bipedal pitting edema	Acute Malnutrition

Department of Health Republic of the Philippines. (2011). *Surveillance in Post Extreme Emergencies and Disasters (SPEED) Operations Manual for Managers*. Retrieved from http://www.wpro.who.int/philippines/publications/speed_operations_manual.pdf

Appendix 10.1

Case definitions: Philippines SPEED (2009)

Health Event CODE (SMS CODE)	Health Event/ Disease (SPEED Form 2)	Main Symptoms/ Signs (SPEED Form 1)	Possible Cause(s)	Immediate Notification Alert Threshold
1. **FEV**	Fever	Fever	_	Unusual clusters or increase
2. **ARI**	Acute respiratory infections	Cough, colds, or sore throat, with or without fever	Common colds, pneumonia, influenza	Unusual clusters or increase
Fever & Acute Respiratory Infections: Increased risk in inadequate shelter, overcrowding, and during the rainy season; also increased risk for the malnourished and those under the extremes of age (<1 year and >60 years)				
3. **MEA**	Suspected Measles	Fever with rash	Measles, German measles, chicken pox	One suspected case
4. **AHF**	Acute hemorrhagic fevers	Fever with spontaneous bleeding (e.g. nose or gum bleeding)	Dengue fever, blood dyscrasias, nutritional disorders, meningococcal disease	One suspected case
Measles : Increased risk in overcrowding, malnutrition, population movement, and <80% Measles immunization coverage (for areas with one suspected case). **Acute Hemorrhagic Fevers:** Increased risk in dengue hemorrhagic fever endemic areas, vector breeding sites (e.g. flooding), poor vector control				
5. **MEN**	Suspected Meningitis	*< 12 months:* fever (> 38° C) with bulging fontanels, or refusal to suckle *12 months and over:* sudden onset of fever (> 38° C) with severe headache and stiff neck	Bacterial meningitis, viral meningitis, encephalitis	2 suspected cases of meningitis in the same week in one evacuation centre or settlement
Meningitis: Increased risk in overcrowding and in areas where there are high rates of acute respiratory infection				
6. **LEP**	Suspected Leptospirosis	Fever with headache, muscle pains and any of the following: eye irritation, jaundice, skin rash, scanty urination	Leptospira infection	One suspected case
Leptospirosis: Increased risk during flooding and contamination of water by rat urine, contact with infected domestic and other animals (dogs, pigs, rats), inadequately treated drinking water sources, poor hygienic conditions in evacuation centers and immediate environment				
7. **AJS**	Acute jaundice syndrome	Yellow eyes or skin with or without fever	Viral Hepatitis, leptospirosis, chemical toxins	At least 3 cases in the same health facility or settlement in a week
Acute Jaundice syndrome: Increased risk of viral hepatitis during overcrowding, when inadequate quantity and/or quality of water, poor personal hygiene, poor washing facilities, poor sanitation				

Health Event CODE (SMS CODE)	Health Event/ Disease (SPEED Form 2)	Main Symptoms/ Signs (SPEED Form 1)	Possible Cause(s)	Immediate Notification Alert Threshold
8. FOS	Fever with other symptoms	Fever with other signs and symptoms not listed above	Malaria, urinary tract infection, typhoid fever	Increasing trends for 3 days associated with or without increase of specific mortality
9. AWD	Acute watery diarrhea	3 or more loose stools in the past 24 hours) with or without dehydration	Cholera, viral/ bacterial gastroenteritis	1 death or a cluster of 5 cases in one week among cases aged 5 yo and up
10. ABD	Acute bloody diarrhea	Loose stools with visible blood	Amebiasis, salmonellosis, shigellosis	A cluster of 3 cases in one week or a doubling of cases in two consecutive weeks
Acute Bloody Diarrhea: Increased risk in overcrowding, inadequate quantity and/or quality of water, poor personal hygiene, poor washing facilities, poor sanitation. Shigella most common cause of bloody diarrhea.				
11. SDS	Skin diseases	Skin diseases	Chemical irritants, infections (scabies)	Unusual clusters or increase
12. CON	Conjunctivitis	Eye itchiness, redness with or without discharge	Chemical irritants, infections (trachoma)	Unusual clusters or increase
Skin disease, Conjunctivitis: Increased risk in overcrowding, inadequate water supply, poor hygienic conditions in evacuation centers and immediate environment, and exposure to chemical irritants such as volcanic dust.				
13. TET	Tetanus	Spasms of neck and jaw (lock jaw)	*Clostridium tetani* infection	One case of suspected tetanus
14. AFP	Acute Flaccid Paralysis	Paralysis of the limbs which occurred recently in a child <15 years who is previously normal	Poliomyelitis, neurologic disorders, electrolyte imbalance, vitamin deficiency	One case of suspected acute flaccid paralysis
Tetanus: Increased risk when there are no safe procedures for traditional births attendants, disruption of immunization program, open wounds due to trauma and poor hygiene **Acute Flaccid Paralysis:** Increased risk of polio when there is disruption of immunization program, overcrowding of none immune groups, and collapse of sanitary infrastructure				
15. WBS	Open Wounds and Bruises	Open wounds and bruises/ burns	Trauma	Unusual clusters or increase
16. FRS	Fractures	_	Trauma	Unusual clusters or increase
Fractures, wounds and bruises: Often caused by falls, collisions against blunt or sharp objects, or thermal injuries, occurring during the direct impact of the emergency or disaster				
17. ANB	Animal Bites	Animal bites	Bites/stings from displaced insects (scorpions), dogs, snakes	Unusual clusters or increase
Animal bites: Risk of rabies associated with dog bites; scorpion stings and snake bites are potentially fatal				
18. HBP	High Blood Pressure	High blood pressure >=140/90	_	Unusual clusters or increase
19. AAA	Acute Asthmatic Attack	Difficulty in breathing and wheezing	_	Unusual clusters or increase
20. KDM	Diabetes Mellitus	NB: May be asymptomatic	_	Unusual clusters or increase
Chronic Non-communicable Diseases: Disruption of drug supply in emergencies or disasters may lead to poor control of blood pressure, asthma, and diabetes and related complications				
21. AMN	Acute Malnutrition	Visible wasting, with or without bipedal pitting edema		One case
Acute malnutrition: Poor food supply; poor water supply and sanitation; poor maternal care, and; inadequate health service due to the disaster may lead to significant increase in malnutrition among children at risk				

Department of Health Republic of the Philippines. (2011). *Surveillance in Post Extreme Emergencies and Disasters (SPEED) Operations Manual for Managers*. Retrieved from http://www.wpro.who.int/philippines/publications/speed_operations_manual.pdf

Appendix 11

Table 35: EWARN-like systems 1997-2017 by WHO (2012) EWARN recommended diseases/syndromes/health events

System	Acute watery diarrhoea (AWB)	Acute bloody diarrhoea (ABD)	Acute jaundice syndrome (AJS)	Acute haemorrhagic fever (AHF)	Acute flaccid paralysis (AFP)	Suspected measles/acute fever and rash	Suspected meningitis	Malaria (confirmed)	*Lower respiratory tract infection	*Pneumonia
Albania 1999	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No
Albania 2000	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No
China	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No
Darfur	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
Fiji	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No
Haiti	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Indonesia	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No
Iraq	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes
Myanmar	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes
Nigeria	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No
Pakistan 2005	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

System	Acute watery diarrhoea (AWB)	Acute bloody diarrhoea (ABD)	Acute jaundice syndrome (AJS)	Acute haemorrhagic fever (AHF)	Acute flaccid paralysis (AFP)	Suspected measles/acute fever and rash	Suspected meningitis	Malaria (confirmed)	*Lower respiratory tract infection	*Pneumonia
Pakistan 2010	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Philippines	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Serbia	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No
Solomon Islands	Yes	Yes	Yes	No	No	Yes	No	Yes	No	No
Somalia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
South Sudan	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No
Syria EWARN	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	No
Syria EWARS	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	No
Yemen	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes

*ARI (specific for LRTI/pneumonia) is optional according to WHO 2012 guideline