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Qurat ul Ain, Abid Saeed, Ehsan Ahmed Larik, Tamkeen Ghafoor, Zubair Ahmed Khosa, Amjad Ali, Abdulrehman Naveed & Tabinda Malik. Evaluation of Event Based Surveillance System of Crimean Congo Haemorrhagic Fever in Balochistan, Pakistan, 2017. *Global Biosecurity, 2019; 1(3).*

RESEARCH ARTICLES

Evaluation of Event Based Surveillance System of Crimean Congo Haemorrhagic Fever in Balochistan, Pakistan, 2017

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Abstract

Background: Crimean Congo Haemorrhagic Fever (CCHF) is an acute viral zoonotic disease that is endemic in Pakistan. Poverty, limited awareness and lack of biosafety practices make it a potential occupational health risk. A poor surveillance system makes it more difficult to monitor the disease burden.

Purpose: An evaluation was carried out to identify the strengths and weaknesses of the event-based CCHF surveillance system in Balochistan, Pakistan, and to propose recommendations for improvement.

Methods: A descriptive evaluation study was conducted at an isolation ward of a public hospital from November 2017 to February 2018 in Balochistan Province. Event-based CCHF surveillance system was evaluated by using updated CDC guidelines for Evaluating Public Health Surveillance Systems. Data were collected through review of records and interaction with stakeholders. Using a semi-structured questionnaire, surveillance system attributes were assessed according to the guidelines in the study tool.

Findings: The system was simple, but had no standardised case definition. It was found to be flexible as new health-related events could be easily incorporated. Data quality was moderate; 80% (75/94) of the reports were completely filled. The system had good timeliness but lacked involvement of the private sector. Acceptability was good with involvement of different government stakeholders. Sensitivity was poor while positive predictive value was 27.5%.

Conclusion: Event based surveillance for CCHF can be improved by involvement of private practitioners and laboratories in the surveillance system to improve representativeness. The timeliness could be improved by adopting an online reporting mechanism. Feedback, support and supervision should be ensured for data quality assurance. Periodic refresher trainings of the staff could be organized.

Key words: Crimean Congo Haemorrhagic Fever, Surveillance, Balochistan

Introduction

Public health surveillance is the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation and evaluation of public health practice. A surveillance system serves as an early warning and detection system for public health events, has an impact on interventions and provides baseline data for decision makers to monitor and set priorities for disease control [1, 2].

Crimean Congo Haemorrhagic Fever (CCHF) emergence is a serious public health problem globally as well as nationally. It is an acute viral disease caused by a Nairovirus of the Bunyaviridae family [3]. The infection is usually transmitted by the Hyalomma Marginatum ticks found on a wide range of animals, particularly cattle and sheep [4]. Hyalomma Marginatum ticks are widely distributed throughout Europe, Asia and Africa. The tick density, environment, infected bird's migration and trans-boundary movements play critical role in virus dispersion [4]. The risk of disease transmission is significantly elevated before Eid-ul-Adha due to increased movement of sacrificial animals across borders [5].

The disease was first reported in 1944. However, CCHF transmission has been reported globally since 1998 [6]. Today, the infection is endemic, with sporadic outbreaks and a 10-40% case fatality rate [7]. The CCHF was analyzed in pregnancy in Turkey (14), Russia (6) and Iran (14) and found to have a maternal mortality of 34% and fetal/neonatal mortality of 58.5% [6]. Pakistan ranks 4th highest in CCHF cases after Turkey, Russia and Iran [8]. In Pakistan, the prevalence of CCHF has been documented since the first reported case, a physician, died while treating a patient with abdominal pain, melena and hematemesis in Rawalpindi [9]. Since 2000, CCHF

sporadic outbreaks have been reported in Pakistan. During 2009- 2014, 91 cases were reported, with an increase in 2012 (141 suspected, 49 lab confirmed and 16 deaths, CFR: 33%) and 2013 (150 suspected, 60 confirmed and CFR: 8%). Karachi, Rawalpindi and Balochistan are the most affected areas in the country. Balochistan province has had a high incidence of CCHF since 2016 [9, 10].

The World Health Organization (WHO) division for communication Disease Surveillance and Response is working on viral haemorrhagic fevers (VHFs) and the development of a Global Surveillance System (GSS). This GSS links local, regional and international networks, websites and training programs like the European Programme for Intervention Epidemiology Training (EPIET). This linkage helps in the sharing of skills and timely dissemination of accurate information [11]. WHO Eastern Mediterranean Regional Office (EMRO) has declared 22 countries as endemic for CCHF infection. In recent years, the number of sporadic outbreaks and incidence of CCHF has been gradually increasing. WHO, along with partners, is working on CCHF early detection and response activities, surveillance, and analytical capacity in Asia, Africa, Middle-East and Europe. In most of WHO EMRO endemic countries, no specific CCHF surveillance program has been established. Event-based surveillance is present in some countries but lack of standardized case definitions, lack of awareness, poor case diagnosis and management, and inappropriate control measures may hinder early detection and notification of CCHF [12].

The current Balochistan surveillance system, operational since 2015, is an event-based system which is activated when a suspected case is reported. However, systematic, periodic paper-based reporting of disease also occurs from the health sector. We aimed to carry out a comprehensive assessment of the existing CCHF surveillance system in Balochistan province, identify its key strengths and weaknesses, and formulate recommendations based on our findings.

Methods

An evaluation study was conducted from November 2017 – February 2018 at the CCHF isolation ward in the public hospital in Quetta. We used the "Updated CDC guidelines for Evaluating Public Health Surveillance System, 2001" for evaluation of the system. The evaluation was done in 2017. As per CDC guidelines 2001[13], system attributes were assessed by following steps:

1. Defining the purpose of the evaluation.
2. Stakeholders identification & engagement in the evaluation process.
3. System description in terms of purpose, operational arrangements and resources used to operate the system.
4. Collect consistent evidence regarding system attributes and performance as per CDC guidelines.
5. Conclusions and recommendations.

Evaluation procedure

For surveillance system evaluation, system-specific stakeholders were identified. The Medical Superintendent (MS) and Medical Officer (MO) of CCHF isolation ward were contacted by telephone and briefed about the evaluation. Once agreed, the team visited the CCHF isolation ward and verbal consent was taken before an interview from each stakeholder. A detailed semi-structured questionnaire addressing system performance and attributes was developed according to CDC guidelines for public health surveillance system 2001 [13]. Ten attributes (usefulness, simplicity, flexibility, data quality, predictive value positive, sensitivity, timeliness, acceptability, representativeness and stability) were evaluated. The MS, MO, provincial District health information software DHIS program coordinator, Technical Support Officer (TSO) in Provincial Disease Surveillance & Response Unit (PDSRU), provincial CCHF focal person for livestock and the medical technician were interviewed on the flow of information, system assessment and data sharing. The surveillance data provided by the isolation ward of the provincial office and the interview data were reviewed. The system attributes were evaluated quantitatively as well as qualitatively. The grading criteria of the system attributes was described as; Excellent, good, average and poor as shown in Table 1 [14].

Table 1. Grading criteria for system attributes

Points	Description
Excellent	The element is present, consistent with the standard described in the (CDC guidelines) instructions and is of a remarkable/outstanding quality.
Good	The element is present and consistent with the standard described in the (CDC guidelines) instructions.
Average	The element is present and may be used even though it may not completely follow the standard described in the (CDC guidelines) instructions.
Low	The element is present but flawed or of poor quality.

Results

Surveillance system description

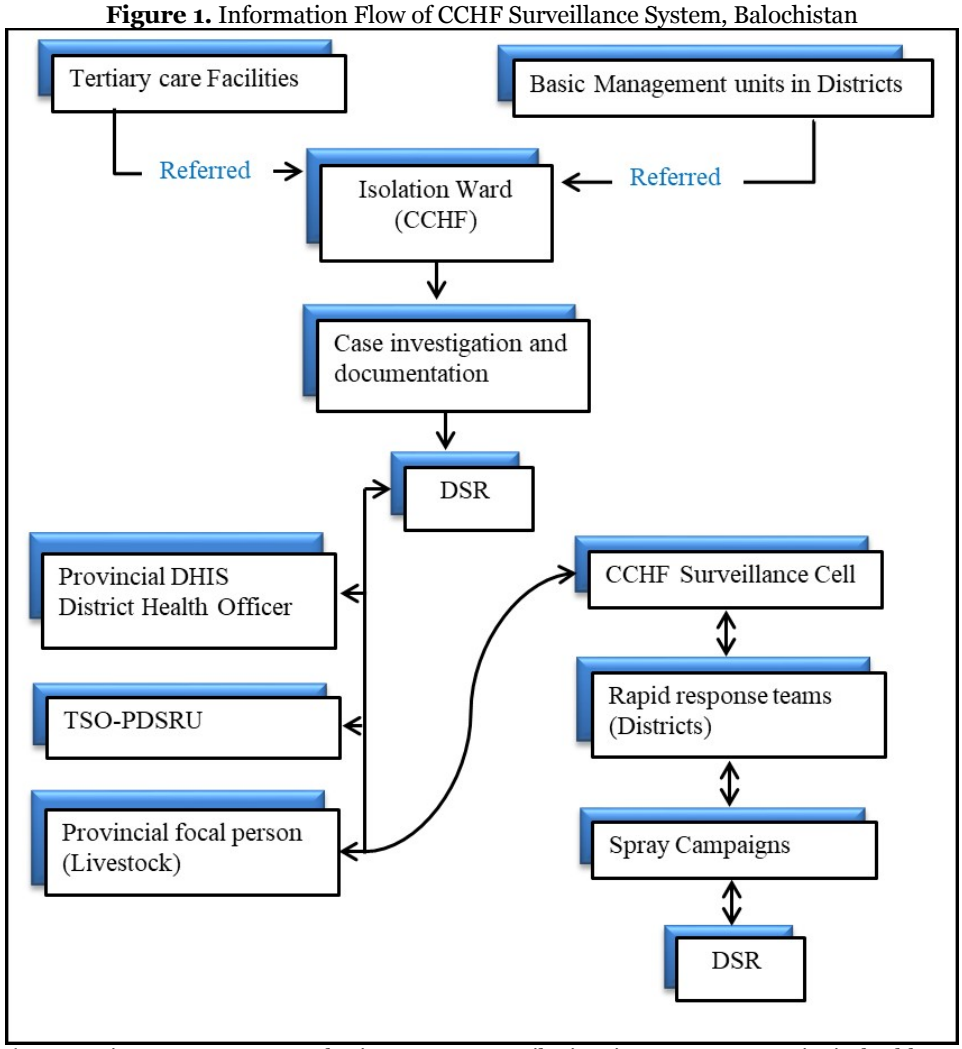
The CCHF surveillance system has been operational in Balochistan province since 2015. It works as an event-based surveillance system which is activated when a suspected case is reported at provincial or district level through the DHIS.

No regular active or routine surveillance is done. Periodic paper-based reporting of disease is done. Currently, only one CCHF isolation ward is designated for all suspected cases, which are referred and treated throughout the province. The system has no proper case definition and there is no laboratory at provincial level. Therefore, few suspected samples are taken and sent to National institute of health (NIH) and Agha khan university (AKU) Karachi for confirmation. The updated data from the CCHF isolation ward is shared with key stakeholders when requested. The system is run by the public sector. Recently, event-based CCH surveillance has been included in Vector borne disease (VBD) control program. Figure 1 shows the information flow for the surveillance system.

Simplicity (Average)

The system has no proper case definition throughout the program. The cases are enrolled on the basis of clinical profile (sign & symptoms), referred reports and animal contact history. There are two organizations (Health Department & Livestock Department) involved and working in parallel, making the flow of information simple and easy to understand. Data from the isolation ward is manually transferred to the district health officer and provincial focal persons (Health, Livestock) within a weekly or monthly time frame. Data follow up and updating are not done because the current provincial isolation ward is functional, and all related cases are referred there. Lack of human resources as well as logistic and financial limitations hinder data management and analysis. Staff training is mandatory to enhance the case finding and management efficiently. Time spent on system maintenance is variable, as staff is overburdened and there is seasonal variability among cases.

Figure 1. Information Flow of CCHF Surveillance System, Balochistan



(CCHF- Crimean Congo Haemorrhagic Fever, DSR - Daily situation report, DHIS- District health information software, TSO- Technical Support Officer, PDSRU- Provincial Disease Surveillance & Response Unit)

Figure 2. Summary of system attributes

No	Attribute	Comments	Remarks
1	**Usefulness**	1. Surveillance System detects CCHF cases, thus enables us to identify, prevent or treat them 2. Estimates the magnitude of morbidity and mortality 3. Identifies trends and is able to detect outbreaks 4. It stimulates research intended to explore and implement the strategies for prevention and control of the disease.	**Good**
2	**Simplicity**	1. No standardized case definition. 2. Simple flow of information i.e. district isolation ward to divisional and provincial focal persons (DHIS, Livestock) 3. Effective integration between public sector institutions while poorly connected to private sector. 4. Passive reporting nature via hard copies only. 5. Collects basic information regarding demographic, presentation and treatment. 8. Does not use any specific computer software for analysis of data. 9. Staff was not trained for data handling.	**Average**
3	**Flexibility**	1. Incorporates other health-related events.	**Average**
4	**Data Quality**	1. Completeness of the case reporting form is about 80%. 2. No mechanisms for monitoring/controlling any errors. 3. Diagnosis made on the bases of clinical signs only. 4. Data is entered and transferred in registers.	**Average**
5	**Acceptability**	1. Only government sector institutions involved. 2. Completeness of reporting forms is around 80%. 3. Daily, weekly & monthly reporting system. 4. Data dissemination rate is linear among the stakeholders.	**Good**
6	**Representativeness**	1. This system is available in 01 district of the Balochistan. 2. Limited integration with private sector practitioners and laboratories. 3. Representativeness is still affected by scattered population, access to health care facility, refugees	**Low**
7	**Timeliness**	1. The reporting is done on a daily, weekly and monthly basis; information reaches from district to divisional and provincial level as per demand.	**Good**
8	**Sensitivity**	1. Sensitivity is supposed to be low as system is event-based, yet not representative of the true population	**Low**
9	**Positive Value Predictive**	1. Total number of suspected cases reported by system in 2017 is 94. 2. Total number of cases confirmed by laboratory is 26. 3. PVP (%) = 26/94×100 = 27.5%	**Low**
10	**Stability**	1. The system does not involve any temporary funding or staff and therefore is less stable in terms of finances. 2. **Stability in term of its reliability**: the system has ability to collect data regarding the cases of CCHF and manage moderately without failure. 3. **Stability in term of its availability**: the system is available for necessary public health action after reporting of cases.	**Average**

Flexibility (Average)

The system has the capacity to accommodate other vector-borne health related events without requiring additional time, personnel or funds. The system is flexible to accommodate new diseases like malaria and dengue fever.

Data Quality (Average)

A manual data management system is used. Data format is partially complete and reporting of disease is based on clinical features; few are confirmed by PCR. The completeness of case files for all reported CCHF cases in 2017 was 80% (75/94). The remaining 20% lacked data on risk factors, serology status and outcome. Completeness and validity of recorded data are compromised due to lack of resources. Most of the stakeholders reported the data at regular intervals, but this reporting system exists in the public sector only as the private sector is not included. Organizational participation in terms of data contribution is low, and private hospitals/clinicians and labs have no input into the CCHF surveillance system.

Acceptability (Good)

Acceptability in terms of personnel participating was good as reported in the stakeholder interviews.

The system is readily accepted by all affiliated health care providers.

Sensitivity (Low)

Sensitivity is the ability of the surveillance system to identify all cases of CCHF. Sensitivity of the surveillance system can be calculated by using the CDC recommended formula: (sensitivity = positive cases/ expected cases × 100). The system does not use a standardised case definition, and positive case identification is done by laboratory confirmation at the province. Sensitivity is assumed to be low, as the system is event-based and is not representative of the whole population. Factors which reduce case identification include long distance, lack of health care facilities, scattered populations, use of traditional healers and significantly low literacy rate (41%) as compared to other provinces (Pakistan Economic Survey 2016-17) [15]. We did not have the data to calculate actual sensitivity.

Positive Predictive Value (PVP) (Low)

On the basis of clinical manifestations, samples are usually collected and sent to Agha Khan University, Karachi and National Institute of Health, Islamabad for confirmation. The total number of CCHF suspected cases reported in 2017 was 94, while the number of true positive cases confirmed by laboratory was 26. The PVP of the surveillance system is calculated as per the CDC guideline. The formulae of PVP is (PVP = total no. of positive cases/ total no. of cases reported × 100). The PVP of the system is 27.6% (26/94×100).

Representativeness (Low)

The isolation ward is established only in district Quetta and provides event-based CCHF surveillance. The representativeness of the system is low because it is geographically limited and has no representation of the private sector. Representativeness is further affected by scattered population, poor access to health care facilities and displaced populations.

Timeliness (Good)

Timeliness of the system is judged to be good. Data is generated on a daily, weekly and monthly basis and disseminated to districts and the provincial level as per demand within the required time. Data feedback is not readily done, but outbreak response is timely.

Stability (Average)

The system is a routine reporting system and does not involve any project based temporary funding. The operational cost is born by public sector. Diagnostic services are not available in province, and only a few samples are sent to NIH and Agha Khan University for confirmation. The system has the ability to be operational when needed in response to reported cases, although has some logistic issues. No monitoring and evaluation is done.

Usefulness (Good)

Data from the isolation ward is summarized and disseminated for use in planning, management and making strategies for prevention & control of disease. The system is useful in determining the case fatality rate of the disease and seasonal trends. Through gaps in identification, it stimulates further research and opportunity to control & prevent the disease with practical interventions.

Discussion

In this study, we evaluated the provincial CCHF surveillance system attributes in 2017. There is no other specific CCHF surveillance program identified in WHO EMR endemic countries [12]. Other countries use varied case definitions, and globally there is no standardized case definition for CCHF, which is a challenge for estimating the true burden of disease. It has also been reported that there is no standardized case definition or contact tracing done in European countries. [16]

The system has strengths and limitations. The evaluation revealed that surveillance data available for quantitative assessment was limited in several ways. There was no contact tracing and missing information on risk factors, particularly for suspected cases with negative laboratory results. A study conducted in Iraq reported the use of three level case definition (suspected, probable, confirmed) to strengthen their surveillance system. However, data quality is compromised in certain ways. The data was available for laboratory confirmed cases only and animal exposure is not clearly ascertained by the program [17].

To maximize early detection and management of CCHF, upgrading the human, veterinary and vector surveillance systems at the provincial and national levels is imperative to identify hotspot areas. A study conducted in Iran highlighted the interdisciplinary collaborative network between Center for Disease Control (CDC), the national expert committee on viral hemorrhagic fever (NECVHF) and the veterinary organisation for establishment of a CCHF surveillance program. This multidiscipline committee focused on awareness, diagnosis, treatment and control. Under CDC guideline and supervision, timely dissemination of information and sample processing was improved, and tick identification, prevention and control programs were established. By implementing these activities, the country was able to decrease disease burden 20% in 2000 and 2% in 2007 [18].

Though sporadic cases are reported from all over the country, Balochistan has experienced increased case counts and fatality rates in recent years. Certain anthropogenic factors such as animal trade, tick density, and climatic and agricultural changes can affect CCHF dispersion. Balochistan is bordered by Afghanistan and Iran. Continuous trans-boundary movement of animals carrying infected ticks increases the risk of disease transmission. In Eastern Europe,

the movement of wild and domestic animals with infected ticks is attributed to increases in seasonal surge [19]. Similarly uncontrolled animal movements and sharing borders with CCHF endemic countries facilitated spread of the virus in Turkey [20].

Conclusion

Event-based CCHF surveillance served as key system for defining the disease burden in the region. The existing system is simple, but lacks a proper case definition and has poor sensitivity and positive predictive value. It is found to be flexible as new health related events could be easily incorporated, yet there are no mechanisms for monitoring and controlling any errors in data quality. The system representativeness can be improved by involvement of the private sector and incorporating data from remote and displaced populations. Retention of isolation wards with qualified staff is an issue, as the operational cost of the system is borne by the public sector. The sustainability of system relies on public investment and financial support.

Recommendations

The CCHF surveillance system gives useful information on disease burden and is one of the few CCHF surveillance systems in the WHO EMRO region. The development of a standard case definition, as well as strengthening of vector, human and veterinary surveillance activities is needed. The functional integration with involvement of the private sector, general practitioners and laboratories can improve surveillance and make outbreak response more effective. Training and refresher courses should be conducted at regular intervals regarding case definition, diagnosis, management and surveillance for all of the related staff. Efforts are required for regular feedback, routine monitoring and communication mechanism between all levels and stakeholders. For system sustainability and evidence-based decision making, the data should be critically reviewed at the provincial level.

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