

Kuehne A, Keating P, Polonsky J, Haskew C, Schenkel K, le Polain de Waroux O, Ratnayake R: Event-based surveillance in low- and middle-income countries: a systematic review

Supplementary file 4: Systematic literature review on event-based surveillance in the field: Usefulness of EBS systems and surveillance attributes evaluated (N=15)

Setting	Publication	Events reported	Level of usefulness	Attributes of surveillance systems							
	Title			Data quality	PPV	Sensitivity	Acceptability	Timeliness	Flexibility	Stability	Other
Outbreak setting	Ratnayake et al. (2016). [21] & ERC (2016). [22]	Overall: 12,126 CEBS alerts, 86% deaths, 14% sickness, <1% unsafe burial, <1% others. Event categories used: 205 >2 persons sick or dead in household, 59 sickness or death after burial, 70 sickness or death in HCW, 191 sickness or death in traveller, 36 sickness of death in contact of case-patient, 7 unsafe burial or washing of corpse, 11,558 others (among them mostly death in community).	Overall: In addition to identification of EVD cases: identification of 3 measles clusters that lead to implementation of control measures and 2 chicken pox clusters.	-	Overall, 12,126. 287 (2%) alerts met the EVD case definition. 16 alerts were confirmed EVD cases. PPV 0.06 (16/287).	Overall 30% (16/53): 16 confirmed EVD cases identified by CEBS. 53 confirmed cases identified in DERC data in total. In Kambia: 38% (5/13) EVD cases were identified by CEBS.	-	Kambia, among 6 cases without epi links: onset to detection: 1-3 days for 4 CEBS identified cases; 5-7 days for 2 non-CEBS identified cases.	-	-	-
	Stone et al. (2016). [19] & ERC (2016). [22]	Overall 9,131 alerts generated: 87% deaths, 13% illnesses. 94% were reported as trigger event 7: other.	-	Proportion of CHM interviewed (n=50) who correctly recalled trigger events: 66% sick/death among 2+ household members; 52% sick/death after unsafe burial/corpse washing; 52% sick/death among health worker or healer; 70% sick/death among recent traveller; 28% sick/death in contact of suspect EVD case; 56% unsafe burial or corpse washing. 48% remembered 4-6 trigger events.	-	-	Proportion of CHM reporting 1/week increased (69% April, 89% May, 83% June, 90% July, 93% August 2015). Of 31 district stakeholders, 74% stated CEBS increased case detection and benefited their district through increased linkage with communities.	-	-	-	Implementation: - steps of implementation were outlined in SOP and included formation of a CEBS management team and endorsement by district and community stakeholders - CHM training completed in 9 districts 03/2015 - telecommunication closed-used-groups not established in 3/9 districts 08/2015 - motorbikes operational in 9 districts 07/2015 - average household to CMH ratio = 118:1 - average CHM to supervisors ratio = 52:1 - most common challenge reported was malfunction of communication tool or lack of motorbike - 13/31 district stakeholders mentioned the need for improved coordination between CEBS and other EVD response - 8/31 district stakeholders were concerned about sustainability of CEBS when DERCs scale down.
	Lee et al. (2016). [20]	a) 11/2014-08/2015: 185,437 calls received. 22,660 of these were Ebola alerts. b) 04/2015-08/2015 in Conakry, Coyah, Debreka, Forecariah: 8,667 calls received. Comparison data: Viral Haemorrhagic Fever (VHF) data base of all Ebola cases in Guinea.	-	-	-	a) 71/ 1,838 (3.9%) of confirmed cases were identified by National Call centre alerts. b) 120/221 (54%) of confirmed cases were identified by	-	-	-	-	-

		a) + b) were matched to VHF by probabilistic record linkage in the absence of unique identifiers. As VHF case numbers decreased, calls to a) + b) increased.				Local Alert Numbers.					
	Miller et al. (2015). [23]	3,299 calls received. 1,296 deaths reported. 1,202 suspect cases reported.	-	-	-	-	-	-	-	-	Response: Convenience sample of 191 notifying lay people called again from call-centre 1 week after their notification if their notification was followed by any response from district Ebola response teams: 81% of 91 deaths alerts were responded to within the next day. 45% of 95 case alerts were responded to within the next day.
	Santa-Olalla et al. (2013). [28]	863 alerts. "The majority of the alerts (89.6%) were related to cholera." "Cholera alerts described increases in cases, deaths, lack of supplies (medical and/or WASH), lack of human resources, and/or prevention activities." Also detected 76 non-cholera alerts, including rabies (canine and human), AFP, diphtheria, varicella, suspected cases of measles, anthrax, intoxications, other hazards (riots, strikes, and others). "The investigation that followed each alert identified major gaps in prevention and response, such as the lack of WASH partners in several departments, and highlighted the need to improve the implementation of prevention and control strategies at the community level."	Actions taken included: field investigation of outbreaks and alerts, rapid set-up of a CTC/CTU or ORP, WASH response, provision of supplies (medical and non-medical) and equipment, provision of human resources for health facilities and community mobilization activities, training on case management, cholera prevention, and control, training for community workers	EBS peaks matched observed increase in IBS cholera numbers.	-	-	Near real-time information and response increased acceptance by local authorities and willingness to keep the system after Who/PAHO left the country.	-	Scope of the system successfully expanded to a broader range of events after initial outbreak phase.	-	Exit strategy: A&R system set-up to establish the basis for an EBS component in the national surveillance system in accordance with IHR requirements. A&R coordinator built local capacity for early detection, investigation & response. System still operating, now text-message-based, but operations remains a challenge for lack of resource.
Routine setting	Clara et al (2018). [15]	370 true events. Type of event known for 253: 24% hand, foot and mouth disease; 21% suspect dengue, 21% chickenpox, 8.3% suspect mumps, 5.9% ARI, 5.5% foodborne disease, 4.7% avian influenza in poultry; <10 reports of suspect rabies, poultry die-off, toxin-related illness etc. Signal incidence rate (~0.1-0.2 signals /100,000 person days) decreased over time.	Reported in previous report.	-	Overall PPV 0.08: 370 events/ 4,854 signals. PPV increased over time, marked temporary increase after monitoring & evaluation visits & implementation of new event definitions. PPV significantly higher after revision of event definition, when compared to the first 5 months of EBS (mean 0.12 vs 0.06, respectively; p < 0.03).	-	Reported in previous report.	-	-	-	Determinants associated with increase in event incidence rate: linear regression MVA with outcome incidence rate, adjusted for "total population, population density, VHW density, and the percentage of communities in the districts with community members and teachers as active informants": VHW density (b = 0.199, p = 0.015) and % of communities with teachers as active informants (b = 0.008, p = 0.024) significantly increase incidence rate.

Clara et al. (2018). [16]	176 true events reported: "Reported events included multiple suspected avian influenza poultry die-offs and human outbreaks of chickenpox, mumps, and foodborne disease."	Total: 2,100 questionnaires:82%–88% of VHW, CHS, and district respondents reported that EBS helps to detect public health events earlier than before.	-	Overall PPV 0.07: 176 events/2,520 signals. Noise:Event = 14:1.	-	Total: 2,100 questionnaires. 85% of VHW and CHS and 77% of district respondents said they were willing to continue participating in EBS. "Key motivating factors for participation expressed by the VHWs were a sense of service to the community, opportunities to increase community ties, and improvement in community trust."	Data from 43 districts (56%): Mean time: detection to notification (district level) = 24 hours; detection to response = 48 hours.	-	-	Sustainability: Total: 2,100 questionnaires: 85% of VHW and CHS and 77% of district respondents said they were willing to continue participating in EBS. Event definition were simplified, see Table 3.
Merali et al. (2018)	Kassena Nankara West: 769 signals, most common: unexpected increase in animal deaths, foodborne illnesses, animal bites. Ketu South: 104 signals, most common: unexpected increase in animal deaths, suspect measles, animal bites.	-	-	Kassana Nankana West: 769 signals, 499 events, 217 responses: PPV (event/signal): 0.65. Noise:event = 1.54:1. Ketu South: 104 signals, 78 events, 78 responses: PPV (event/signal): 0.75. Noise:event = 1.33:1.	-	-	-	-	-	Lessons learned: training and understanding of community volunteers increased detection and reporting; strengthened reporting mechanisms facilitated immediate reporting. CEBS worked best in settings with strong social cohesion and community engagement where volunteers are the gateway to the health system. Challenges remain balancing sensitivity of signals and poor response.
Larsen et al. (2017) & (2016). [17,18]	-	-	-	-	-	22 interviews with CBVs, 2 FGD with CBVs & 2 FGD with VSSs: - community members accepted CBVs and had high expectations. CBVs were well appreciated - most volunteers wanted CEBS to continue despite the lack of incentives	-	-	-	Volunteer experiences: 22 interviews with CBVs, 2 FGD with CBVs & 2 FGD with VSSs: Motivation was to help their communities, some were expecting some kind of incentives. Some CBVs had too many communities to look for. Training that provided them with new knowledge on diseases was well perceived but refresher training would have been needed. Limited understanding of case definitions. Lack of mobile network as biggest challenge.
Toyama et al. (2015). [24]	126 rumours reported: 71% measles, 11% suspect rabies, 4% Anthrax, 3% whooping cough, 3% AFP, 2% neonatal tetanus, single rumours of meningitis, AWD, floods, malnutrition.	57/81 (67%) verified alerts resulted in responses: case management (n=45), active case finding (n=8), vaccination (n=2), patient referral to hospital (n=2)	05/2014: 41/59 (69%) HC have log books available, 11/2014: 54/59 (91%) HC have log books available. 29/126 (23%) rumours have no records of assessment. 37/126 (29%) rumours have complete data on reporting & response time	Overall PPV 0.64: 81 events/126 rumours, PPV measles 0.63 (57/90); rabies 0.57 (8/14), anthrax 1.00 (5/5), whooping cough 0.75 (3/4), AFP 0.50 (2/4), neonatal tetanus 0.5 (1/2). Noise:event = 1.55:1	Verified rumours of suspect rabies, anthrax, AFP & neonatal tetanus outnumbered cases reported by IBS.	38/126 (30%) of rumours were reported from the community.	Median time: onset to reporting: 3.8 days. Median time: reporting to response: 0.6 days, Total delay from onset to response 4.4 days.	-	-	-
Oum et al. (2005). [30]	Outbreaks reported: 21 total; 2 outbreaks of malaria, 7 AWD, 10 measles, 2 VHF. All outbreaks but one measles outbreak were confirmed true.	-	-	Overall PPV 0.95: 21 outbreaks reported, 20 proved to be true outbreaks. 1 measles outbreak was not confirmed true. Noise:event = 1.05:1	-	-	-	-	-	Costs: annual cost of CBSS about US\$0.5 per capita including training, supervision, and evaluation. Time: VHW spend 3-4 half days/months collecting information + ad hoc reporting and meeting participation
Naser et al. (2015) [26]	5,887 meningo-encephalitis cases in 10 surveillance hospitals, 62	-	-	Overall PPV 0.17 as 10/62 clusters were	Sensitivity: 176/5,887 (3%)	-	-	-	-	-

	identified encephalitis clusters, of which 10 clusters included Nipah cases.			Nipah clusters. Among 176 suspect cases in 62 clusters, 62 Nipah cases were confirmed (PPV 0.36). Among 982 suspect cases identified in case-based surveillance, 23 Nipah cases were confirmed (PPV 0.03)	meningo-encephalitis cases were identified with cluster surveillance.						
Sharma et al. (2009). [29]	44,484 calls. Among these 1,185 health related calls and 112 outbreak alert calls. In August 2009 remit extended to providing information and advice on Influenza A (H1N1) and received 16,357 calls in August 2009.	-	-	112 outbreak alert calls lead to the detection of 9 outbreaks.	-	-	-	-	-	-	-
Tante et al. (2015). [25]	-	-	-	-	-	-	-	-	-	Operational: 54% (6/11) units had no interruption in ESR operation. 3/11 units had <1 week interruption. 2 hardest hit units had limited operationality for 7 weeks. Functionality: 73% (8/11) surveillance units after by typhoon considered ESR functional post-typhoon. 91% (10/11) rated PIDSR functional & 27% (2/11) rated SPEED as functional.	Complementariness: 64% (7/11) rated the 3 surveillance systems as complementary to each other. But no events were reported through ESR, even though it was functional, because SPEED had a similar function.
Dagina et al. (2013). [15]	61 events reported: 26% AWD, 15% ILI, 11% acute gastroint. syndromes, 10% acute fever and rash, 8% acute neurological syndromes, 5% acute febrile illness, 5% other respiratory disease. Source of reporting: PHO (24/61), HCW (15/61), media (7/61), NGO (4/61), community (4/61). The system also identified a chemical event and a nutritional emergency.	For 11% (7/61) unclear if any steps were taken for verification. 56% (34/61) events were investigated by the PHO, a minority with additional support from NDOH or WHO. 18% (11/61) were investigated by NDOH or WHO without the PHO.	-	Overall PPV: 0.84: 51 events verified/61 events reported. 3/61 discarded as untrue. 7/61 not verified. Noise:event = 1.20:1	-	-	Median time: onset to reporting (n=36): 10 days. Median time: reporting to response (n=14): same day. For 10 events onset-report: > 30d.			Laboratory confirmation: 31% (16/51) had confirmed or probable aetiology.	