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Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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An indicator framework for the monitoring and evaluation of event-based surveillance systems

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Appendix 1: Technical Workshop to Revise the Africa CDC Framework for Event-Based Surveillance - Roster of Participants

6th – 9th July 2022 in Nairobi, Kenya

Africa CDC:

1. Dativa Aliddeki	Africa CDC, Eastern RCC	Kenya
2. Franck Chi Amabo	Africa CDC, Central RCC	Gabon
3. Kyeng Mercy	Africa CDC HQ	Ethiopia
4. Wari Numbere	Africa CDC HQ	Ethiopia
5. John Ojo	Africa CDC HQ	Ethiopia
6. Fatma Osman	Africa CDC HQ	Ethiopia
7. Stephanie Salyer	Africa CDC HQ	Ethiopia
8. Bethelhem Tibebe Tesfaye	Africa CDC HQ	Ethiopia

Member States:

9. Herbert Bakiika	Ministry of Health	Uganda
10. Simwaba Davie	National Public Health Institute	Zambia
11. Mohamed Fawzy	Ministry of Health and Population	Egypt
12. Raymond Hamoonga	National Public Health Institute	Zambia
13. Muntari Hassan	Nigeria Centre for Disease Control	Nigeria
14. Shimaa Abu Kamer	Ministry of Health and Population	Egypt
15. Joshua Kayiwa	Ministry of Health	Uganda
16. Tsepang Lorraine Lekhela	Ministry of Health	Lesotho
17. Ntsoaki Mokete	Ministry of Health	Lesotho
18. Emmanuel Mwakapasa	Ministry of Health	Tanzania
19. Philip Ngere	Ministry of Health	Kenya

Partners:

20. Leonidas Alexakis	European Centres for Disease Control	Sweden
21. Arunmozhi Balajee	Global Fund	Switzerland
22. Adam Crawley	U.S. CDC	USA
23. Andrea Capbianco Dondona	Food and Agricultural Organization	Italy
24. Comfort Mankga	Health Information Systems Program	South Africa
25. Mohamed Mohamed	ECSA Health Community	Tanzania
26. Alain Ondzie	Wildlife Conservation Society	Congo Republic
27. Calvin Sindato	Southern Africa Center for Infectious Disease Surveillance (SACIDS)	Tanzania
28. Paolo Tizzani	World Organisation for Animal Health	France
29. George Sie Williams	WHO, African Regional Office,	Congo Republic
30. Rahel Yemanaberhan	Resolve to Save Lives	Ethiopia

Appendix 2: Event Based Surveillance Monitoring and Evaluation Indicators

Guidance:

The indicators included below are split into a routine monitoring indicator table and an evaluation indicator table. The included indicators are aligned with the indicators found in the updated 2023 version of Africa CDC’s Event-Based Surveillance Framework but may slightly differ in wording and formatting – we have noted where these differences occur in the table.

Countries should begin their M&E process by focusing on the routine collection of data to support monitoring indicators, as these should be achievable measurements for most programs. Evaluation indicators can be incorporated into periodic evaluation efforts aimed at assessing specific components of the EBS system.

The indicators presented should be considered as a baseline for thorough monitoring and evaluation of an EBS system. While the authors consider this set of indicators as ideally the minimum data that are collected, they acknowledge that not every single indicator included below will be applicable or feasible for every EBS program to measure. If this is the case, implementing organizations should begin by monitoring and evaluating as many indicators as possible, with the goal of gradually modifying processes or staffing to accommodate all or most indicators. Since a single set of EBS monitoring and evaluation indicators cannot satisfy all the needs of every program, organizations may also wish to augment this set with additional measurements or adapt the indicators presented to their specific country contexts.

It should be noted that monitoring and evaluation of performance data, as prescribed below, can be complemented by other inputs, such as qualitative data generated from simulation exercises to identify gaps and challenges to be addressed.

Acronyms:

C: community level;

CHW: community health worker;

E: evaluation;

EBS: event-based surveillance;

EMS: event management system;

F: facility level;

I: intermediate level;

L: local level;

M: routine monitoring;

Mixed: mixed, qualitative and quantitative methods;

N: national level;

N/A: not applicable;

POE: point of entry;

Qual: qualitative methods;

Quant: quantitative methods;

SOP: standard operating procedures;

TWG: technical working group

Event Based Surveillance <u>Routine Monitoring</u> Indicators							
Indicator	Indicator Description	Numerator	Denominator	Disaggregates	Data Source	Freq.	Level
Outcomes							
Timely event detection	Proportion of events detected within 7 days of event start	Number of events detected within 7 days of event start	Total number of detected events	Geographic area; EBS type	EBS reporting tools, EMS, 7-1-7* related data	Quarterly	N, I, F, L, C
Timely event verification	Proportion of events verified within 24 hours after detection	Number of events verified within 24 hours of detection	Total number of events detected	Geographic area; EBS type	EBS reporting tools, EMS	Quarterly	N, I, F
Timely event notification†	Proportion of events which were reported within 24 hours of detection	Number of events reported within 24 hours of detection	Total number of events detected	Geographic area; administrative level; EBS type	EBS reporting tools, EMS, 7-1-7* related data	Quarterly	N, I, F
Timely event risk assessment	Proportion of verified events for which the first risk assessment was conducted within 24 hours of verification	Number of events for which the first risk assessment was conducted within 24 hours of verification	Total number of events verified	Geographic area; EBS type	EBS reporting tools, EMS	Quarterly	N, I
Timely event notification‡	Proportion of events which were notified (i.e., an alert was issued for action) within 24 hours after verification	Number of events notified within 24 hours of verification	Total number of events verified	Geographic area; EBS type	EBS reporting tools, EMS, 7-1-7* related data	Quarterly	N, I, F

Event Based Surveillance <u>Routine Monitoring</u> Indicators							
Indicator	Indicator Description	Numerator	Denominator	Disaggregates	Data Source	Freq.	Level
Timely initial response†	Proportion of events for which all early response actions* were completed within 7 days of notification	Number of events for which all applicable early response actions were completed within 7 days of notification to the responsible authority	Total number of events notified to the responsible authority	Geographic area; EBS type	EBS reporting tools, EMS, data from Response Unit, 7-1-7* related data	Quarterly	N, I
Outputs							
Personnel trained to conduct EBS	Proportion of personnel trained in EBS	Number of EBS staff trained	Total number of EBS staff	Geographic area; administrative level; cadre of personnel; EBS type	EBS annual workplan, EBS training reports	Quarterly	N, I, F, L, C
Signals detected‡	Proportion of signals detected by an EBS source and reported for triage	Number of signals detected and reported for triage by an EBS source	Total number of signals detected by EBS sources	Geographic area; EBS source; cadre of personnel; sector; signal type	EBS reporting tools, EMS	Weekly	N, I, F, L, C

Event Based Surveillance <u>Routine Monitoring</u> Indicators							
Indicator	Indicator Description	Numerator	Denominator	Disaggregates	Data Source	Freq.	Level
Signals triaged	Proportion of signals triaged	Number of signals triaged	Number of signals detected and reported for triage	Geographic area; signal type	EBS reporting tools, EMS	Weekly	N, I, F, L, C
Signals which underwent verification†	Proportion of triaged signals that underwent verification	Number of signals verified as events	Number of triaged signals that passed	Geographic area; signal type	EBS reporting tools, EMS	Weekly	N, I, F
Signals verified as events	Proportion of signals verified as events	Number of signals verified as events	Number of signals that underwent verification	Geographic area; signal type	EBS reporting tools, EMS	Weekly	N, I, F
Events characterized by risk level	Proportion of events that underwent risk assessment	Number of events assessed for risk	Total number of events	Risk level (low, moderate, high, very high); signal type; geographic area	Risk assessment tool; EBS reporting tools; EMS	Weekly	N, I
Events responded to‡	Proportion of events responded to, characterized as medium to high-risk level, for which a response was initiated	Number of medium to high-risk events responded to	Total number of events assessed as medium to high-risk	Signal type; risk level (low, moderate, high, very high); geographic area	EBS reporting tools, EMS	Weekly	N, I, F, L, C
EBS sites reporting on time	Proportion of EBS sites reporting monitoring data within prescribed timeframe	Number of sites reporting monitoring indicators within prescribed timeframe	Total number of EBS sites	Geographic area	EBS reporting tools; EMS	Monthly	N, I, F, L, C

Event Based Surveillance <u>Routine Monitoring</u> Indicators							
Indicator	Indicator Description	Numerator	Denominator	Disaggregates	Data Source	Freq.	Level
EBS site-level data available	Proportion of surveillance units within each administrative level routinely reporting EBS data	Number of surveillance units per administrative level where EBS data is available to inform surveillance activities	Total number of surveillance units conducting EBS per administrative level	Geographic area; administrative level	EBS Monitoring Tool; Surveillance Reports/Bulletins	Quarterly	N, I, F, L, C
Activities							
EBS trainings are conducted‡	Number of EBS trainings conducted	Number of EBS trainings conducted	N/A	Level (national, intermediate, local); cadre; EBS type	EBS annual workplan, EBS training reports	Quarterly	N, I, F, L, C
Multi-sectoral TWG meetings are held‡	Proportion of planned multi-sectoral EBS technical working group (TWG) meetings held to guide EBS implementation	Number of multi-sectoral stakeholder technical working group meetings held	Total number of planned technical working group meetings specified by an implementation plan	National level	Program records; TWG Meeting Minutes / Roster	Quarterly	N
Surveillance units establish EBS within jurisdiction‡	Proportion of surveillance units (or equivalent) at each administrative level that establish EBS	Number of surveillance units that establish EBS	Total surveillance units	Level (national, intermediate, local)	EBS annual workplan	Quarterly	N, I, F, L, C

Event Based Surveillance <u>Routine Monitoring</u> Indicators							
Indicator	Indicator Description	Numerator	Denominator	Disaggregates	Data Source	Freq.	Level
Facilities establish EBS‡	Proportion of facilities within country that establish EBS	Number of facilities that establish EBS	Total facilities	Level (national, intermediate, local)	EBS annual workplan	Quarterly	F
Supportive supervision visits are conducted‡	Proportion of planned supportive supervision visits conducted to EBS sites	Number of supportive supervision visits conducted to EBS sites	Total number of planned supportive supervision visits	Geographic area	Program records	Quarterly	N, I, F, L, C
Inputs							
Establishment of a Multisectoral TWG	EBS Multisectoral Technical Working Group established at the national level to guide EBS implementation	EBS multi-sectoral TWG established at the national level	N/A	National level	EBS workplan, EBS TWG meeting minutes and roster	Once	N
Equipment and reporting tools are procured and available‡	Number of sites implementing EBS that received equipment and reporting tools	Number of sites implementing EBS with equipment and reporting tools	Total number of sites implementing EBS	Geographic area	EBS annual workplan, EBS budget	Yearly	N, I, F, L, C
EBS priority events are determined	Priority events to be included in EBS are identified and signal definitions drafted	Priority EBS events identified and signal definitions drafted	N/A	National level	EBS annual workplan	Yearly	N

Event Based Surveillance <u>Routine Monitoring</u> Indicators							
Indicator	Indicator Description	Numerator	Denominator	Disaggregates	Data Source	Freq.	Level
EBS staff and key stakeholders available to implement EBS activities‡	Number of EBS-related staff available to implement EBS	Number of staff and key stakeholders available to implement EBS	N/A	EBS setting; administrative level		Yearly	N, I, F, L, C
EMS established	Electronic event management system that captures, analyses, and reports event-related data is in place	Electronic event management system that captures, analyses, and reports event-related data is in place	N/A		EMS	Yearly	N, I, F

* 717 recommends tracking the dates associated with the start of an event, event detection, first notification or reporting of an event to a health authority, and early response efforts. Specific 717 indicators and definitions are listed here: <https://717alliance.org/digital-toolkit/#0>

† Indicator introduced to help better align with 7-1-7 recommendations and inform the timeliness associated with the initial stages of EBS reporting within before a risk assessment and alert/notification is issued for action.

‡ Indicator has been slightly modified from the Africa CDC Framework to improve clarity.

Event Based Surveillance <u>Evaluation</u> Indicators						
Indicator	Indicator Description	Numerator	Denominator	Methods	Data Source	Level
Impact						
Reduced mortality	Mortality rate in a specified population for a priority event under surveillance is reduced compared to the previous year(s)	Deaths in specified population for priority event	Number of persons in specified population	Quantitative	EBS reporting tools, EMS, all-cause mortality reports	N
Reduced morbidity	Morbidity rate in a specified population for a priority event under surveillance is reduced compared to previous year(s)	Persons in specified population with morbidity due to priority event	Number of persons in specified population	Quantitative	EBS reporting tools, EMS	N
Reduced spill-over	Proportion of zoonotic events (initially detected in the animal population) that spilled over into, or led to human cases is reduced in comparison to previous year(s)	Number of zoonotic events detected in the animal population that spilled over into the human population	Total number of zoonotic events detected in the animal population	Quantitative	EBS reporting tools, EMS	N
Reduced spread of events	Proportion of events that impacted more than 1 district is reduced compared to previous year(s)	Number of events that spread to >1 district	Number of all events reported	Quantitative	EBS reporting tools, EMS	N, I
Reduced event response costs	Amount that event response costs are reduced compared to previous year(s)	Event response costs	N/A	Mixed	EMS, budgetary reports, costing analysis	N
Cost-effectiveness of EBS	Cost effectiveness of outbreak detection and response using event-based surveillance	Cost of investments in the event-based	Costs of outbreak detection and response activities for events under	Quantitative	Cost-effectiveness analysis	N

		surveillance system	surveillance in jurisdictions not implementing event-based surveillance			
Increased country support for EBS	Proportion of funding from the government for EBS programme has increased, due to improved EWAR, compared to prior year(s)	Funding allocated to EBS from government	Total EBS budget	Quantitative	EMS, budgetary reports, EBS annual workplan	N
Outcomes						
Usefulness and quality of EBS data for decision-making*	<p>Proportion of decision-makers who responded with an average score ≥ 4 across four key criteria on Likert scale rating from EBS staff and key decision-makers on four key criteria:</p> <p>(1) how useful are EBS data for outbreak detection and response (1=not at all useful; 5=very useful);</p> <p>(2) whether EBS system in their site/jurisdiction is sensitive enough (1=not at all sensitive, 5=very sensitive);</p> <p>(3) whether EBS system in their site/jurisdiction is specific enough (1=not at all sensitive, 5=very sensitive);</p> <p>(4) how well EBS data are trusted and considered accurate (1=not at all trusted, 5=very well trusted).</p>	Number of decision-makers whose scores across four key criteria averaged ≥ 4	Total number of decision makers surveyed	Mixed	Questionnaires, interviews, focus groups	N, I, F, L, C
Sensitivity	Proportion of high-risk health events that were detected through EBS out of all health events that	Number of high-risk health events detected through the EBS system	Total number of unique high-risk events reported	Quantitative	EBS and IBS reporting tools and databases, EMS, other surveillance databases	N

	were detected by any means over the past year		through both IBS and EBS			
Positive predictive value (PPV)	Probability that a signal detected corresponds to a genuine health risk (verified event)	Total number of events	Total number of signals	Quantitative	EBS reporting tools, EMS	N
EBS system utility*	<p>Proportion of community leaders and government stakeholders who responded with an average score ≥ 4 across four key criteria on Likert scale rating from EBS staff and key decision-makers on four key criteria:</p> <p>(1) how useful is the EBS system for outbreak detection and response (1=not at all useful; 5=very useful);</p> <p>(2) whether EBS system in their site/jurisdiction is sensitive enough (1=not at all sensitive, 5=very sensitive);</p> <p>(3) whether EBS system in their site/jurisdiction is specific enough (1=not at all sensitive, 5=very sensitive);</p> <p>(4) how well the EBS system is trusted (1=not at all trusted, 5=very well trusted).</p>	Number of community leaders and government stakeholders whose scores across four key criteria averaged ≥ 4	Total number of community leaders and government stakeholders surveyed	Mixed	Questionnaires; semi structured interviews including focus groups with all staff and supervisor/mentor interviews.	N, I, C
EBS workforce motivation	Proportion of EBS workforce with improved motivation to implement EBS functions	Number of EBS workforce with improved motivation to	Total number of EBS workforce surveyed	Mixed	Questionnaires; semi structured interviews including focus groups with all staff and	N, I, F, L, C

	Likert scale rating from surveillance workforce surveyed on self-assessed motivation levels, and self-assessed competency in implementing EBS functions	implement EBS functions			supervisor/mentor interviews	
EBS workforce competency	Proportion of surveillance staff with improved competency in analysis and interpretation of EBS data for early warning surveillance	Number of EBS staff with improved competency in analysis and interpretation of EBS data	Total number of EBS workforce assessed	Mixed	Questionnaires; semi structured interviews; focus groups with all staff; and supervisor/mentor interviews.	N, I, F, L
EBS workforce capacity	Proportion of trained EBS staff actively engaged in EBS activities	Number of trained EBS staff actively engaged in EBS activities	Total number of trained EBS staff	Mixed		N, I, F, L, C
EBS workforce improved knowledge	Proportion of EBS staff with improved knowledge and skills in EBS from pre to post test	Number of EBS staff with improved knowledge and skills from pre to post test	Total number of trained EBS staff	Mixed	Pre and post test	N, I, F, L, C
Outputs						
Personnel equipped to conduct EBS	Proportion of personnel with the appropriate materials/resources at each level	Number of EBS staff equipped	Total number of EBS staff	Mixed	Program records; EBS training reports	N, I, F, L, C
Activities						
EBS evaluation site visits are conducted*	Proportion of sites implementing EBS where evaluation site visits are conducted (including data review, focus groups, and key informant interviews, as appropriate)	Number of sites implementing EBS evaluated	Total sites implementing EBS	Mixed	EBS annual workplan, EBS evaluation report	N, I, F, L, C

EBS signals are updated periodically*	Frequency that EBS signals are reviewed and/or updated	Number of times per year that EBS signals are reviewed and/or updated at the national level	N/A	Mixed	Program records	N
EBS reporting units are using digital systems*	Proportion of reporting units using digital systems for EBS	Number of sites utilizing digital systems for EBS	Total sites implementing EBS		Program records	
Inputs						
Existence of EBS signals for all sources/sites	EBS signals are defined for detection of priority events at all levels and in all settings	N/A	N/A	Mixed	EBS evaluation report	N, I, F, L, C
EBS implementation sites and sources identified	Administrative levels and EBS types identified for EBS implementation	N/A	N/A	Mixed	EBS annual workplan, EBS evaluation reports, EBS reporting tools, EMS	N, I, F, L, C
EBS technical guidelines and SOPs are approved and available for use	Proportion of sites (by EBS type and administration level) implementing EBS that have the EBS technical guidelines and SOPs available	Number of sites implementing EBS with guidelines and SOPs	Total number of sites implementing EBS	Mixed	Guidelines, SOPs, EBS evaluation reports	N, I, F, L, C
National EBS focal point established	National EBS focal point established	N/A	N/A	Mixed	Program records	N
EBS implementation workplan is available*	National EBS implementation workplan developed and available	N/A	N/A	Mixed	Program records	N
EBS training materials are available*	EBS training modules and training materials developed, approved and available for use	N/A	N/A	Mixed	EBS Training Materials; Program records	N

EBS M&E tools are available*	EBS monitoring and evaluation tools are developed and available for use	N/A	N/A	Mixed	Program records	N
EBS M&E plan is available*	Availability of an M&E plan agreed to by stakeholders and regularly updated	N/A	N/A	Mixed	Program records	N
Amount of EBS budget available	Amount of budget allocated to EBS implementation	N/A	N/A	Quant	Type	N

* Indicator has been slightly modified from the Africa CDC Framework to improve clarity

