



# From Signals to Action: Enhancing Respiratory Disease Surveillance with Event-Based Methods: An Expert Opinion

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## Abstract

The workshop From Signals to Action: Enhancing Respiratory Disease Surveillance with Event-Based Methods examined the integration of Event-Based Surveillance (EBS) into national respiratory disease surveillance systems. Experts and participants explored EBS's role in detecting early signals of outbreaks from non-traditional sources like social media, news, and community networks, complementing Indicator-Based Surveillance (IBS). Key presentations showcased successful case studies from Oman and Lebanon, emphasizing the importance of cross-sectoral collaboration and the integration of human, animal, and environmental health surveillance.

Discussions highlighted the challenges of data standardization, verification, and ensuring timely response. Tools like the World Health Organization's Epidemic Intelligence from Open Sources (EIOS) were emphasized as valuable for the media scanning component of Event-Based Surveillance (EBS), utilizing a multi-hazard approach to detect signals from diverse information sources. The tool's effectiveness was exemplified during mass gatherings, where it supported real-time data collection and analysis to identify potential public health threats. Participants from conflict-affected countries, including Sudan shared how EBS had been crucial in maintaining surveillance when formal systems collapsed. The workshop highlighted the importance of political commitment, sustainable funding, and capacity building to sustain EBS systems. Future challenges like staff turnover and the need for simple, accessible reporting systems in low-resource settings were discussed. Overall, the session stressed that EBS is essential for early detection of public health threats and should be fully integrated into national and regional surveillance frameworks to strengthen health system resilience.

**Keywords:** *Respiratory Disease Surveillance, Event-Based Surveillance, Indicator-Based Surveillance.*

## Introduction

Respiratory diseases are a significant cause of morbidity and mortality worldwide. Respiratory illnesses, including influenza, tuberculosis, and coronavirus disease of 2019 (COVID-19) are responsible for a significant proportion of the global disease burden, particularly in low- and middle-income countries <sup>[1,2]</sup>. The emergence of new and highly infectious respiratory pathogens, such as Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes COVID-19, has highlighted the need for effective respiratory disease surveillance systems <sup>[3]</sup>.

Surveillance systems for respiratory diseases are critical for detecting outbreaks early, monitoring and characterization of viral circulation, assessing severity, identifying high-risk populations, and guiding public health response <sup>[4]</sup>. Traditional surveillance systems for respiratory diseases typically rely on passive reporting of cases by healthcare providers, which can be slow, limited in terms of data

quality, and often restricted to monitoring specific diseases. Active surveillance systems, which include laboratory testing and epidemiological investigation such as sentinel influenza surveillance systems, can provide more timely and accurate data on respiratory disease outbreaks but can be resource-intensive and challenging to implement if not well planned <sup>[5]</sup>.

Event-based surveillance (EBS) offers a complementary approach to traditional surveillance systems for respiratory diseases. EBS involves the systematic monitoring of a diverse range of sources, including media reports, social media, communities, informal healthcare providers, such as traditional healers and community health volunteers, formal healthcare providers such as health facilities, and relevant sectors like agriculture and education, for signs of unusual or unexpected events, such as disease outbreaks <sup>[5-7]</sup>. EBS can be used to detect respiratory disease outbreaks earlier than traditional surveillance systems, allowing for a more rapid public health response <sup>[5]</sup>. However, integrating EBS into existing

surveillance systems presents several challenges, including the need for standardized data collection and analysis procedures, the availability of reliable data sources, and the need for efficient communication and coordination between public health agencies and other stakeholders, such as healthcare providers, researchers, and local communities [8,9].

To effectively address these challenges, it is vital to prioritize the timely verification and analysis of collected data and ensure the widespread communication of interpreted findings [10]. This necessitates the development of updated mechanisms for promptly analyzing the gathered data considering complementary findings from other different respiratory surveillance systems at the country level for a clearer picture and effectively disseminating the insights and conclusions to the relevant stakeholders for timely prevention and response measures [5].

Despite these challenges, there are several successful examples of EBS being integrated into respiratory disease surveillance systems in different countries and contexts. This session explored the benefits and challenges of integrating EBS into existing surveillance systems and identify strategies for overcoming these challenges. The session will provide a platform for sharing best practices and lessons learned from successful case studies, with the goal of improving timely public health response to respiratory disease outbreaks.

## Workshop Description

The workshop was implemented as a well-structured, interactive session, incorporating expert presentations, case studies, panel discussions, and active participant engagement, creating an environment for both knowledge dissemination and dialogue on the future of EBS in respiratory disease surveillance. It started with a series of presentations by key speakers, each focusing on different aspects of EBS integration into respiratory disease surveillance systems.

The implementation included:

1. **Opening Session:** The workshop began with an introductory session led by the moderator, outlining the objectives and goals of the session, which were to explore the use of EBS to enhance respiratory disease surveillance, discuss successful case studies, and address the challenges and opportunities of integrating EBS within existing health systems.
2. **Presentations by Key Experts:**
  - Dr. Mahmoud Sadek provided an overview of EBS as part of the WHO's Integrated Disease Surveillance strategy, explaining its role as the early warning arm of surveillance in the Eastern Mediterranean Region (EMR). His presentation emphasized the integration of EBS with Indicator-Based Surveillance (IBS) and the need for a collaborative surveillance framework, highlighting on successful experiences of establishing EBS systems in Qatar and Saudi Arabia during FIFA World Cup 2022 and Hajj respectively. He also gave a brief overview of the Mosaic Respiratory Surveillance Framework, which supports national authorities in identifying key respiratory virus surveillance objectives and determining the best approaches to achieve them [11].
  - Dr. Salah Al Awaidey and Dr. Nada Ghosn presented successful case studies from Oman and Lebanon, respectively, showcasing the practical application of EBS in their countries' respiratory disease surveillance systems.

3. **Panel Discussion:** After the presentations, the workshop transitioned to a panel discussion. The panel comprised the key presenters and invited experts, who engaged with participants in an interactive question-and-answer session. This discussion addressed critical challenges such as political commitment, the integration of human and animal health surveillance, and the importance of standardizing data across different sectors.
4. **Audience Interaction and Engagement:** Throughout the workshop, participants actively engaged with the speakers, asking questions and sharing their own experiences with EBS implementation. This interactive format allowed for peer learning and the sharing of best practices from various countries, particularly those with ongoing EBS pilot programs.
5. **Conclusion and Next Steps:** The workshop concluded with a summary of the key points discussed and an outline of the next steps for enhancing respiratory disease surveillance through EBS. The moderator emphasized the importance of cross-sectoral collaboration, the need for sustainable funding mechanisms, and the critical role of EBS in fragile and conflict-affected settings.

## Objectives of the workshop

This preconference workshop, titled "From Signals to Action: Enhancing Respiratory Disease Surveillance with Event-Based Methods," was conducted as part of Eastern Mediterranean Public Health Network (EMPHNET's) 8<sup>th</sup> Regional Conference, "Advancing Public Health Preparedness and Response." The aim of this preconference workshop was to showcase successful examples of integrating EBS into existing respiratory disease surveillance systems in different countries and contexts.

It also aimed to discuss the challenges and opportunities of integrating EBS into respiratory disease surveillance systems and identify strategies for overcoming challenges and improving public health response to respiratory disease outbreaks. The workshop had the following specific objectives: To provide an overview on WHO framework for resilient surveillance for respiratory pathogens of epidemic and pandemic potential; To provide an overview of the concept of EBS and illustrate its pivotal role in resilient respiratory disease surveillance; To present case studies of successful integration of EBS into respiratory disease surveillance systems in different countries and contexts; To discuss the challenges and opportunities of integrating EBS into existing surveillance systems, including the need for standardized timely data collection and analysis procedures, reliable data sources, efficient communication and coordination between public health agencies and other stakeholders, and distribution of interpreted data widely; To engage participants in a dialogue on the potential benefits and challenges of integrating EBS into respiratory disease surveillance systems and identify areas for future research and collaboration.

## Findings

### • The Role of EBS in Early Detection of Respiratory Pathogens

Dr. Mahmoud Sadek introduced WHO Eastern Mediterranean Regional Office's (EMRO) framework for Integrated Disease Surveillance (IDS) [13] and the critical role of EBS as a part of this system in the EMR. He highlighted the need for EBS to act as the early warning arm of surveillance, particularly in contexts where traditional surveillance systems are limited or insufficient. His presentation explained how EBS complements Indicator-Based

Surveillance (IBS) by allowing the collection of unstructured, real-time data from informal sources. This ability enables faster detection of unusual public health events, such as clusters of respiratory disease cases, before they manifest in formal healthcare data.

A key insight from Dr. Sadek's presentation was the concept that EBS complements traditional surveillance by capturing signals from non-traditional sources like social media, news reports, and community networks. The success of EBS relies heavily on integrating these data streams into the broader surveillance architecture while ensuring that the information collected is rapidly verified and acted upon. He also discussed the critical importance of early detection and real-time monitoring, stating that by the time traditional indicator-based systems report an outbreak, it may be too late to prevent widespread transmission.

In practice, Dr. Sadek shared examples from the EMR region, notably in Libya, Afghanistan, and Sudan, where EBS has been implemented despite complex and fragile health systems. In Sudan, EBS proved to be the only operational surveillance system during periods of conflict, continuing to provide early warnings and helping to mitigate public health threats, while traditional systems collapsed. This case demonstrates that EBS is not just a complementary system, but in some instances, a lifesaving backbone of public health surveillance.

- **Case Studies on Successful EBS Implementation in Oman and Lebanon**

- **Oman's Experience with EBS**

Dr. Salah Al Awaidy detailed Oman's integrated surveillance approach, which links EBS with traditional IBS systems, particularly in its Early Warning and Response Network (EWARN). Oman's experience highlights the power of inter-sectoral collaboration, as the Ministry of Health works closely with the ministries of agriculture, education, and the environment to capture a wide range of signals from different sectors. This multi-sectoral approach ensures that not only human health threats are captured but also environmental and zoonotic threats, such as avian influenza, which could trigger human respiratory outbreaks.

Dr. Al Awaidy stressed the importance of establishing monitoring and evaluation (M&E) frameworks to ensure the EBS system remains effective, and that data is continuously verified for accuracy. Oman's use of community health workers and non-health sectors as critical components of their surveillance network underscores the importance of local-level involvement in EBS, particularly in early detection of respiratory disease outbreaks.

- **Lebanon's Use of EBS for Respiratory Disease Surveillance**

Dr. Nada Ghosn presented Lebanon's experience in integrating EBS into its national respiratory disease surveillance system. The key components for EBS included media scanning, a call center and community-based surveillance.

Media scanning involves a daily process where public health officials monitor online news, social media, and other publicly available information for signals related to priority conditions. The scanning methods include the use of search engines such as EIOS and manual searches. Call centers enable real-time reporting from the public and healthcare professionals. These centers are integrated into both EBS and IBS systems, ensuring a seamless flow of data. Community-based surveillance enhances the system's ability to capture signals from the community level. These various EBS components collectively helped reduce the time lag between detection and response, improving Lebanon's capacity to respond swiftly to respiratory disease outbreaks.

Dr. Ghosn also discussed the challenges Lebanon faced, particularly in ensuring data accuracy and managing the verification process due to the unstructured nature of data collected through EBS. The need for cross-sectoral collaboration was highlighted, with Dr. Ghosn noting that coordination between health, education, and agriculture sectors was crucial for maintaining the system's effectiveness.

- **Questions and Answers**

During the workshop, the discussion section brought together insights from both the panel and participants. The panel, comprising experts in respiratory disease surveillance and EBS, explored the challenges and opportunities of integrating EBS within national systems. They shared successful case studies, focusing on early detection and the importance of collaboration across sectors.

Participants were highly engaged, raising pertinent questions about the real-world application of EBS. One recurring topic was the impact of EBS on public health outcomes, where experts highlighted key metrics such as outbreak detection speed and response time. They emphasized the importance of integrating human and animal health surveillance, with EBS filling the gaps left by traditional IBS, particularly in fragile settings. The discussion also covered the challenges of data verification, such as determining the accuracy and reliability of signals from non-traditional sources like social media or community reports, filtering false positives, and ensuring that the verified data aligns with existing surveillance frameworks. The use of data hubs to improve coordination and streamline the verification process among stakeholders.

Participants from various countries shared their experiences, underscoring the need for cross-sectoral collaboration, especially between ministries of health and agriculture, and emphasizing the role of community health workers in reporting respiratory disease signals at the local level. They raised concerns about over-complicating reporting systems, particularly in resource-limited areas, and proposed maintaining simple, robust reporting mechanisms to ensure sustainability.

A particularly interesting part of the discussion was the role of technology, where tools like WHO's Epidemic Intelligence from Open Sources (EIOS) were praised for improving media scanning and gathering real-time data during mass gatherings like the World Cup in Qatar and Hajj in Saudi Arabia. Participants were keen to learn how this technology could be adapted to their local contexts.

Several participants also sought clarity on how to sustain EBS in conflict settings like Sudan and Afghanistan, where the healthcare infrastructure is often limited. The panellists recommended building community-based surveillance systems to maintain continuity. Future challenges, such as maintaining staff capacity amidst high turnover, were discussed, with solutions focusing on continuous training and institutional memory frameworks.

## **Discussion of the findings**

The findings from the workshop 'From Signals to Action: Enhancing Respiratory Disease Surveillance with Event-Based Methods' highlight the significant potential of EBS as a complementary tool to traditional surveillance systems for respiratory diseases. The integration of EBS, which systematically captures unstructured signals from non-traditional sources such as online news, social media, news reports, and community networks, can substantially improve early outbreak detection, particularly in low-resource and conflict-affected settings [5]. This discussion section explores the implications of these findings, supported by relevant evidence, and highlights the challenges that need to be addressed to optimize the

integration of EBS into national and regional surveillance frameworks.

- **EBS as an Early Warning Tool**

EBS plays a critical role in early detection, which is essential for rapid response during respiratory disease outbreaks. The workshop showcased how countries such as Sudan successfully leveraged EBS to maintain public health surveillance during periods when traditional IBS systems were disrupted by conflict. These examples underline the resilience of EBS in fragile settings, where its flexibility enables the monitoring of disease signals despite infrastructural challenges [8]. Studies have shown that EBS can often detect outbreaks earlier than IBS by capturing signals from informal sources, leading to quicker public health interventions and ultimately reducing morbidity and mortality [15,16].

The successful use of EBS for respiratory disease surveillance in Oman and Lebanon further illustrates its value. In Oman, the integration of EBS with traditional surveillance through EWARN demonstrated how cross-sectoral collaboration-incorporating signals from agriculture, education, and environmental health-can enhance the comprehensiveness of disease detection [17]. Similarly, in Lebanon, the proactive use of media scanning, call centers and community-based surveillance contributed to the timely detection of respiratory infections, highlighting how EBS can be used to bridge gaps in traditional surveillance systems [18].

- **Data Standardization and Verification Challenges**

Despite its potential, integrating EBS into existing surveillance frameworks presents challenges, particularly concerning data quality and standardization. Data from informal sources such as online news and social media can be difficult to verify and often require substantial effort to validate. This was a recurring theme in the workshop discussions, where participants stressed the importance of adopting standardized verification protocols to improve data reliability. Previous studies have highlighted the need for such standardization to ensure that EBS can effectively contribute to national surveillance systems without compromising data accuracy [10,19].

- **The Role of Multi-Sectoral Collaboration**

The workshop discussions also highlighted the importance of multi-sectoral collaboration in enhancing the effectiveness of EBS. The One Health approach, which integrates human, animal, and environmental health surveillance, was identified as a critical element in detecting zoonotic diseases, such as avian influenza, that can have significant public health implications. Oman's success in linking health and agricultural surveillance demonstrates the benefits of such collaboration, particularly in early detection and prevention of cross-species disease transmission. Effective multi-sectoral coordination ensures that respiratory disease outbreaks can be detected at the human-animal-environment interface, reducing the risk of broader public health impacts [17].

- **Sustaining EBS in Fragile and Conflict-Affected Settings**

Maintaining the functionality of EBS in fragile and conflict-affected settings requires a focus on community-based surveillance systems, which have proven to be instrumental in collecting timely data when formal health services are disrupted. The experiences shared by participants from Sudan indicate that community engagement and local-level reporting are key to sustaining EBS in these contexts [15]. Community health workers play an essential role in this process, providing a bridge between informal signals and formal public health systems. Investing in capacity-building for these workers is

crucial to ensure the long-term sustainability of EBS, especially in conflict-affected areas where high staff turnover is a significant challenge [8].

- **Future Directions**

The future of EBS lies in its integration into broader public health intelligence systems, rather than limiting its application to specific disease outbreaks. Expanding EBS to encompass a range of public health threats, including vector-borne and waterborne diseases, could enhance countries' preparedness for a variety of health emergencies. However, this expansion requires strong political commitment and sustainable funding mechanisms to support the necessary infrastructure and workforce. Donor alignment is essential to avoid fragmented funding streams that limit the scope and effectiveness of EBS [16]. Additionally, the role of technology-such as EIOS- in improving media scanning for EBS purposes, specifically by capturing articles and information with potential public health importance, was highlighted as a key area for future investment [20].

## **Conclusion**

The workshop "From Signals to Action: Enhancing Respiratory Disease Surveillance with Event-Based Methods" highlighted that the integration of EBS with traditional systems has potential to play a significant role in the future of public health surveillance. In an increasingly interconnected world, where respiratory disease outbreaks can spread globally in a matter of hours, the importance of early detection through innovative and agile methods like EBS cannot be overstated.

Through rich discussions and evidence-based presentations, this workshop emphasized the potential of EBS as an important tool in public health surveillance, particularly in low-resource and conflict-affected regions where traditional systems often fall short. EBS not only fills critical gaps but also strengthens health system resilience, allowing for faster responses and potentially mitigating the spread of deadly pathogens before they spiral out of control. The case studies from Oman and Lebanon highlighted that, when implemented effectively, EBS has the potential to enhance national surveillance systems and could contribute to saving lives.

However, this potential can only be fully realized with strong political commitment, sustainable funding, and multi-sectoral collaboration. The workshop emphasized the urgent need for governments and international stakeholders to prioritize the scaling of EBS, ensuring it is fully embedded within IDS frameworks. Additionally, the importance of data standardization, cross-border cooperation, and capacity-building emerged as critical elements in the long-term sustainability of EBS systems.

This workshop was not just a dialogue, but a call to action. EBS is a potentially valuable tool, and now the challenge lies in ensuring it becomes a permanent fixture in the global health security landscape. By capitalizing on its strengths and addressing the challenges discussed, countries can be better prepared for the next pandemic, ensuring that public health responses are not just reactive, but proactive, agile, and effective.

## **Declarations**

### **Ethics approval and consent to participate**

Not Applicable

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## Conflict of interest

None

## Consent for publications

Not Applicable

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