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Systematic Review of the Integrated Epidemiological Surveillance System in the African Region: Performance, Challenges and Prospects

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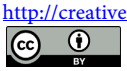

Abstract

Background: A quarter of a century after its launch, the Integrated Disease Surveillance and Response (IDSR) strategy remains at the heart of Africa's efforts to build a public health system capable of detecting, analysing and remediating epidemic threats, as well as responding quickly to them. **Objective:** The objective of this systematic review is to review and document the achievements and challenges regarding the implementation of the integrated epidemiological surveillance system in the WHO African Region and to facilitate the identification of common obstacles to anticipate future health events. **Method:** In accordance with PRISMA recommendations, we conducted a peer-reviewed literature review that was published over the period from January 2010 to January 2026 on Google Scholar and PubMed verifying the predefined inclusion criteria. The Mendeley software allowed us to eliminate duplicates, while Excel 2021 was helpful for data extraction and analysis. **Results:** Of the 51 articles that were included, 09 focused on the entire WHO Africa region, while 42 focused on specific countries in the region. About 70% (n = 35) of these were published over the period 2015-2019 and 53% (n = 28) linked several diseases to the implementation of the IDSR strategy. The IDSR has made significant progress in Africa, with improved timeliness and completeness of data, increased efficiency of critical functions, and significant support for polio-related infrastructure to strengthen surveillance of priority diseases. However, the review highlights recurring challenges: insufficient human and

financial resources, supply disruptions, low data quality and integration, under-reporting of diseases, lack of training and supervision, as well as coordination and communication problems at all levels of the health system. **Conclusion and Perspectives:** The IDSR has contributed to strengthening epidemiological surveillance; however, these performances vary by country and remain weakened by persistent structural challenges. Building resilient health systems requires stronger resources, integrated data, digital innovation, and robust governance to sustain gains against emerging and recurrent threats.

Keywords

Integrated Epidemiological Surveillance System, Africa, Performance, Challenges, Prospects

1. Introduction

Epidemiological surveillance is the production of continuous epidemiological information on a health problem, to identify appropriate actions to remedy it [1]. Countries in the WHO African Region frequently experience outbreaks of infectious diseases, resulting in widespread morbidity, disability and death. The magnitude of the impact of these health problems is exacerbated by weak surveillance, preparedness and response systems leading to delayed detection and ineffective response to these outbreaks [2]. To this end, the international community has recognized the importance of a solid and functional strategy of Integrated Disease Surveillance and Response (IDSR) [3].

Adopted in 1998 by the World Health Organization African Region (WHO-AFRO), the IDSR was intended to serve as a comprehensive strategy to improve disease surveillance and improve the laboratory and response capacities of WHO member states in Africa [4]. It was developed in response to a range of emerging and re-emerging diseases that have caused the deaths of large numbers of people in the African region [5]-[7]. This strategy targeted nineteen (19) priority communicable diseases, which are divided into four categories: *Diseases with epidemic potential*, *diseases targeted for eradication*, *diseases targeted for elimination and endemic diseases* [4]. The emergence of new diseases, conditions and events has necessitated a rethinking of public health priorities for surveillance and response [2] [8]. To this end, the International Health Regulations (IHR) adopted and revised in 2005 required a revision of the 1998 IDSR strategy in 2010 [9]. This revision proposed a modification of the typology of diseases under surveillance into five categories as follows: *epidemic-prone diseases*, *diseases targeted for eradication or elimination*, *other major diseases*, *events or conditions of public health significance*, *and diseases or events of international concern* [9] [10]. As the health situation in the WHO African Region continues to evolve, a third revision of the 2010 IDSR took place in 2019 [11] and which was in line with the guidance of the

fifty-sixth session of the WHO Regional Committee for Africa in 2006 [12], the 2016-2020 emergencies (including COVID-19) in the WHO African Region and using the opportunities offered by new information technologies such as mobile phone networks, increased broadband internet connectivity and electronic monitoring systems [13]. Since the Integrated Monitoring and Reporting System (IMSR) and the requirements of the IHR (2005) share common objectives, WHO Member States in the African region have decided to use the strategy IDSR revised 2010 as the basis for the implementation of the IHR (2005) [7]. Especially since the IDSR and IHR frameworks offer low-income countries the opportunity to leverage their limited resources to continuously improve their disease surveillance and response systems [14].

An effective surveillance system collects, analyzes, and interprets data quickly and accurately, facilitating a rapid response to outbreaks [13]. The effectiveness of such a surveillance system lies in its ability to adequately monitor health events in order to generate quality and timely information that can be used to carry out appropriate public health actions [15] [16]. Regular monitoring ensures the relevance and effectiveness of the system, identifying strengths and weaknesses to enable continuous improvements. Thus, the evaluation of the integrated epidemiological surveillance system is of particular importance [17]. To this end, WHO recommends a regular assessment of the core functions of the revised 2010 IDSR and supporting functions (guidelines, laboratory capacity, supervision, training, resources and coordination) at all levels of the health system [15] [18]. In this momentum, in 2009, Uganda was among the first countries to conduct an evaluation of the IDSR and it documented successes and challenges, including inadequacies and inconsistencies at the national level in the core activities of the IDSR and support functions such as training, support supervision, communication, and feedback [19]. In addition, one of the key requirements of the IDSR strategy is the development and dissemination of information products, including the writing and publication of scientific articles on IDSR, to inform policymakers' decision-making [3]. Indeed, a review of the published literature, particularly that on recent outbreaks, can help to identify areas where the implementation of the IDSR is working well and those where it remains weak, highlighting areas for research and prioritization [2]. However, peer-reviewed scientific articles as information products on the IDSR are still rare [2].

The objective of this systematic review is to review and document the achievements and challenges in the implementation of the integrated epidemiological surveillance system in the WHO African Region and to facilitate the identification of common barriers to anticipate future health events. This systematic review integrates recent research and health systems strengthening efforts in the Africa region to reinforce the findings of previous studies. We will identify the key factors for good performance that will strengthen the achievements of health surveillance systems in the WHO African Region; It will also be a question of identifying the challenges and recommendations made in terms of the IDSR.

2. Methodology

2.1. Scope of the Study

The present study is restricted to the African region, as it remains the epidemiological focus of most health problems including: cholera, meningitis, measles, poliomyelitis, yellow fever, malaria and several emerging diseases [20]. Moreover, the choice of this zone is linked to the fact that most African countries suffer from comparable health ills and share similar difficulties in terms of epidemiological surveillance. In this study, we consider integrated epidemiological surveillance as a public health strategy that aims to harmonize the collection, analysis and use of data on priority diseases to enable early detection and rapid response [21]. By performance, we mean the ability of integrated epidemiological surveillance to fulfil its missions and produce the expected effects. In this case, we assess the performance of the IDSR strategy, a framework adopted by WHO Africa since the late 1990s to harmonize the epidemiological surveillance system in the region, according to the core functions assigned to it and updated as it is revised. These include case identification, reporting, data analysis and interpretation, investigation and confirmation of cases and possible outbreaks, preparedness, response, information flow and evaluation and improvement of the surveillance system [21]. The absence or weakness of any of these criteria will be seen as a challenge to be overcome in terms of prospects. Also, we will look at the challenges in terms of resources, logistics and coordination.

2.2. Search Strategy

In accordance with the PRISMA 2009 recommendations [22], we conducted a peer-reviewed literature review that was published over the period from January 2010 to January 2026. To this end, Google Scholar and PubMed are the two databases that were consulted. The top search terms included "Integrated Epidemiological Surveillance System", "Performance", "Challenges", "Assessment", "Challenges" and the English equivalents in the title and abstract of the indexed literature. We have systematically consulted all the scientific work on the subject. To do so, we reviewed titles and abstracts using the inclusion and exclusion criteria described below. Full-text articles of titles and abstracts checking the inclusion criteria were uploaded and reviewed for data collection. In addition, we used the reference lists of included studies. A careful reading of the titles and abstracts of full-text articles was done independently to identify eligible articles in each database. We then made a summary of each database. Finally, we checked and managed duplicates with Mendeley reference citation software.

2.3. Inclusion and Exclusion Criteria

Only articles that met the following criteria were included in this review:

- Have been published in a peer-reviewed scientific journal; and
- Have been peer-reviewed, in full text; or
- Have been published by the World Health Organization; and

- Have been published between January 2010 and January 2026; and
- Have been published in English or French; and
- Focus on countries in the WHO African Region; and
- Be "Open Access"; and
- Address the surveillance system, performance and challenges of implementing the IDSR strategy, or address the surveillance of diseases covered by the IDSR framework.

Thus, the exclusion criteria are as follows:

- Not have been published in a scientific journal (except which published by the WHO); or
- Have been published only as abstracts or presented at conferences without being accompanied by full publications; or
- Be published before the year 2010 or from February 2026; or
- Have been published in a language other than French or English; or
- Relate to a country or region outside WHO-Africa; or
- Require payment to access the full text; or
- Address topics other than the IDSR strategy, or address diseases covered by the IDSR framework but that did not link the surveillance system or their findings to the IDSR strategy.

2.4. Article Selection Procedure

To reduce bias, each included article was independently double read. Indeed, each reading consisted of the one hand of a complete and detailed examination of the article (titles/abstracts and full texts), and on the other hand of the analysis of the content of the article according to the inclusion criteria. In the event of divergent decisions between the two reviewers on the inclusion or exclusion of a reviewed article, in-depth discussions will be reached to reach a consensus. In the event of a lack of consensus, it is sent to a third reading to decide.

2.5. Risk Analysis of Article

A risk assessment of the included articles was carried out to evaluate their quality and the risk of bias associated with their inclusion in the systematic review. For each included article, we used the following indicator to assess this risk:

$$\text{Risk} = 1 - \frac{\sum_{j=1}^{5} \text{criteria score}_j}{20}$$

where criteria score_j is the article's score for criterion *j*. Table 1 below presents the said evaluation criteria, as well as the associated reference scores.

A safe article (0%) verifies the inclusion and exclusion criteria for articles for inclusion, was published in 2026 (in the first quarter at the time of submission of the article), uses the IDSR strategy to assess the surveillance system of diseases under epidemiological surveillance in African countries. The risk ranges from 0 (almost zero risk) to 100% (very high risk). **Appendix 1** presents the results of the risk assessment of the inclusion of items. On average, the articles included present

a 35% (+/− 15%) risk of bias according to the criteria used. Half of them were less than 30% at risk. The riskiest included article had a score of 65% and one article had no risk of inclusion. This analysis shows that the articles included have overall little risk of bias on the review. To further reduce this risk, the articles have been cited according to the geographical area and the diseases they cover.

Table 1. Risk assessment criteria and references scores.

Criteria	Article reference and nature	Temporal relevance (seniority)	Thematic alignment (IDSR)	Coverage and relevance of selected diseases	Coverage and geographic relevance	Risk
Reference	Checks inclusion criteria = 4; Otherwise = 0	2026 = 4; 2020-2025 = 3; 2015-2020 = 2; 2010-2015 = 1	IDSR = 4, Otherwise = 1	Multiple = 4, Unique = 1	Africa = 4, One country = 1	0%

Source: Authors.

2.6. Data Extraction and Analysis

For each of the selected articles, we collected three (03) types of information (variable), namely:

- Performance indicators such as case identification, reporting, data analysis and interpretation, investigation and confirmation of cases and possible disease outbreaks, preparedness, response, information flow, evaluation and improvement of the surveillance system.
- The challenges encountered in terms of human, financial, and logistical resources and coordination.
- The perspectives, which include the reforms, innovations and digital integration proposed by the authors.

To do this, we used a standardised and digitised reading grid using Excel 2021 software. This software was also used for the synthesis and visualization of the results. The data was consolidated using a mixed approach: a narrative analysis to identify recurring themes and a tabular presentation to structure the performance indicators. The results were compared by country and subregion using performance matrices [speed of reporting, completeness, quality of data], to identify convergences and divergences. Finally, a cross-sectional analysis highlighted continental trends and local specificities, based on a thematic classification and standardised quantitative indicators. **Appendix 2** presents the results of this work.

2.7. Ethical Considerations

The drafting of this review required constant ethical vigilance. We have made the effort to respect academic integrity through correct citation and faithful presentation of the work, while ensuring transparency in the choice of sources. We have also placed particular emphasis on equity and representativeness of perspectives, integrating a variety of research. Finally, the communication of the results was

done in an honest and balanced manner, recognizing the limitations and uncertainties of the existing literature.

2.8. Limitations of the Study

For the purposes of this review, the search was limited to studies conducted in the WHO-Africa area, potentially excluding relevant data from countries outside WHO-Africa and outside the continent that have implemented national surveillance aligned with the IDSR. In addition, the research was limited to English and French studies, which may have reduced the sample size and introduced language bias. Also, relevant articles that are not "open source" have escaped the scope of this review. Despite these limitations, the results remain valuable for applications in Africa and similar contexts to identify strategies to overcome barriers and strengthen facilitators to improve the implementation of the IDSR.

3. Results

3.1. Description of Selected Articles

Without specifying a study period, we consulted a total of 172 articles, of which 56% (97 articles) on PubMed and 44% (75 articles) on Google Scholar. Of these articles, only 68% (117 articles) met the study period criterion (January 2010 to January 2026), including 66 articles on PubMed and 51 articles on Google Scholar. After reading the titles and abstracts of each article, 66 articles (including 54 on PubMed and 12 on Google Sholar) were retained in the two databases. Subsequently, 12 articles were excluded because they did not meet the criteria of the IDSR and 03 articles were duplicated (duplicated). Thus, a total of 51 articles were included in this systematic review. Of the 51 studies that were included, we noted that 09 covered the entire WHO Africa region, while 42 focused on specific countries in the region.

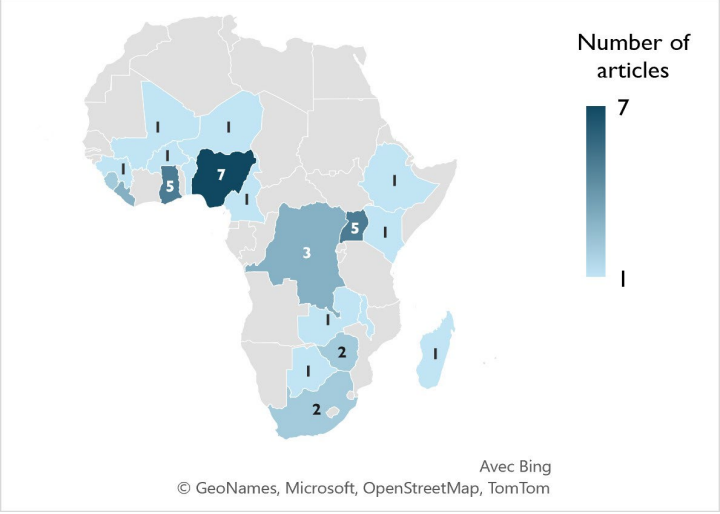

Figure 1. Distribution of included items by WHO Africa country. Source: Authors, Excel 2021.

Figure 1 above shows the distribution of the items included by WHO Africa Country. Almost half (43%) of the selected articles focused on West African countries, with most of the work focusing on Nigeria (07 articles) *i.e.* 32% of the articles selected. Then the most represented articles were about Uganda and Ghana with 05 items each; and after Liberia (03 articles), Kenya (02 articles), Zimbabwe (02 articles), Sierra Leone (02 articles), Ethiopia (02 articles) and DR Congo (02 articles). The other countries had only one article represented. It is South Africa; Cameroon; Malawi; Tanzania; Zambia; Madagascar; Botswana; Mali; Niger; Guinea; Burkina Faso and Benin.

The analysis of the evolution of the number of articles included over time (Figure 2 below), shows that about 70% (n = 35) were published between the years 2015 and 2019. The spike in publication over this period can be explained by the publication of the IDSR evaluation criteria in 2015, which served as the basis for evaluation studies in individual countries and in the region. Since 2019, the pace of publication on the IDSR strategy has dropped, probably due to the focus of studies on the Covid 19 pandemic.

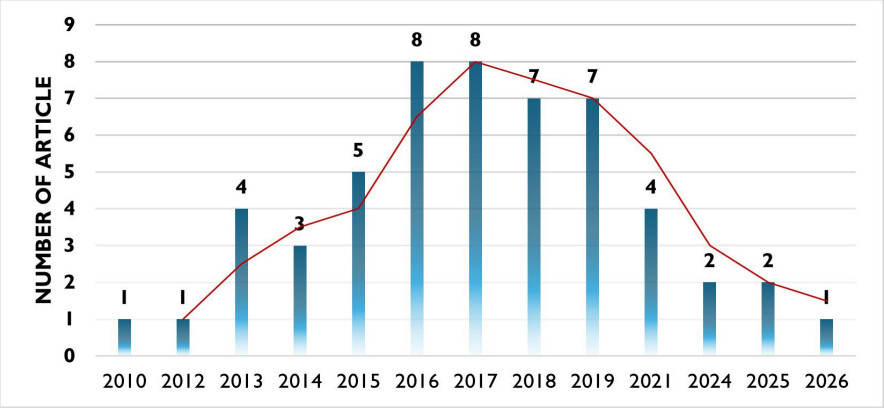

Figure 2. Evolution of the number of articles published (included) between 2010 and 2026. Source: Authors, Excel 2021.

Figure 3 below shows the distribution of the included items according to the priority diseases they treat. Of these articles, 53% (n = 28) or just over half link several diseases to the implementation of the IDSR strategy; 11% (n = 06) relate exclusively to Ebola virus disease; 8% (n = 04) on malaria; 6% (03) on poliomyelitis and cholera respectively; 2% on co-infection of Ebola virus disease (n = 01), Lassa fever (n = 01), rubella (n = 01), neonatal tetanus (n = 01), measles (n = 01), tuberculosis (n = 01), influenza (n = 01), vaccines (n = 01), maternal mortality (n = 01) and peripheral diseases (n = 01) respectively.

3.2. Twenty-Five Years of Implementation of the IDSR: Major Advances in Africa

After twenty years of implementation, Socé Fall *et al.* (2019) showed that significant progress had been associated to the IDSR, with 32 countries (68%) reaching

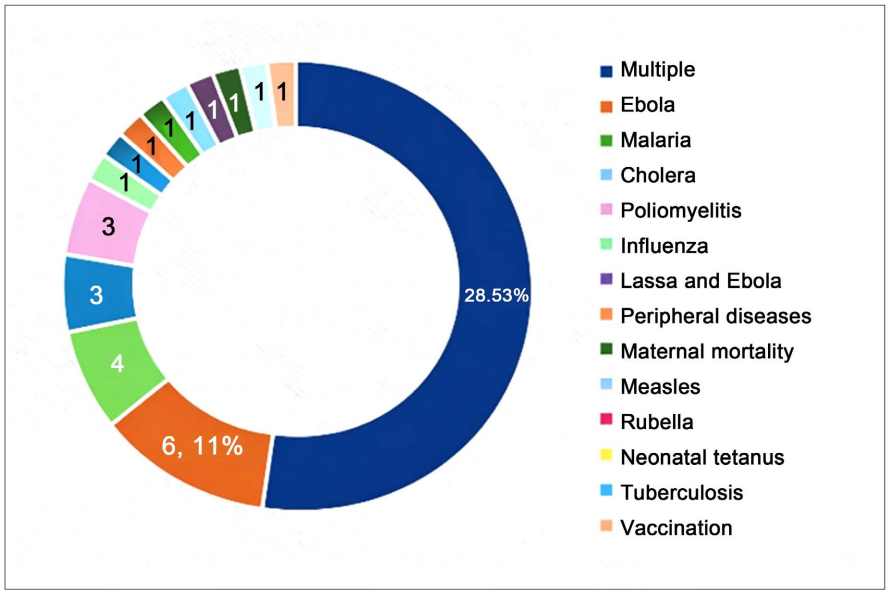

Figure 3. Distribution of included articles by priority diseases. Source: Authors, Excel 2021.

the timeliness and completeness threshold of at least 80% of reporting units [3]. In 2021, Wolfe *et al.* confirmed effective implementation across all critical and support functions of the IDSR, including priority disease detection, data reporting and analysis, information dissemination, laboratory functionality, and staff training [2]. In addition, Mwengee *et al.* (2016) showed that in seven countries, polio eradication infrastructure supported surveillance of other priority diseases, with robust data reporting, rapid detection of outbreaks, and strengthened response capacities [23]. Finally, Poy *et al.* (2014) confirmed that improved in data availability from IST Polio-funded managers were associated to IDSR [24].

The results show that several countries in the WHO Africa region recorded Notable progress in the implementation of the IDSR. In Sierra Leone, the timeliness of the data was reaching 93% in 2016 and 97% in 2017, with suspected outbreak detection of 96% (n = 87) in 2016 and 100% (n = 85) in 2017 [25]. In Zambia, major successes have been noted, including an operational response at all levels, dedicated staff and budgets, and the adoption of WHO technical guidelines adapted to the national context [26]. In Malawi, the completeness of monthly reports reached 73.1% [27]. In Uganda, district reporting has been increased from 49% in 2001 to 85% in 2007, the local analysis of 10% to 47% [$p < 0.01$], and a decrease in the cholera case fatality rate of 3.2% to 2.1% was observed [19]. In Nigeria, 88.9% of professionals submitted the IDSR002 forms within two days [28]. In Liberia, the use of mobile applications and the AVADAR platform helped maintain performance above the 80% threshold [29], with 65% of structures receiving supervision and 58% providing community feedback (34). Other countries have also shown achievements: in Benin, a good level of performance for the "structure" component and an average level for "processes" and "results" [30]; in Ghana, an increase in monthly completeness (+9%) and on-time performance

(+37%), as well as a weekly improvement (+79% and +24%) [31]; in Kenya, 44% of the structures had adequate notification [32]; in Zimbabwe, 79.7% of agents used the data generated and 59.5% found implementation easy [33]; and in Ethiopia, a threefold reduction in malaria-related admissions and deaths between 2005 and 2009 [34]. These studies highlight Concrete progress: improved timeliness and completeness of data, strengthened detection and response, adoption of digital tools, and measurable impacts on mortality, while highlighting differences in performance across countries.

3.3. Twenty-Five Years of Implementation of the IDSR: Persistent Challenges in Africa

In 2019, Fall *et al.* showed that only 12 countries (26%) had achieved the target of 90% coverage of the IDSR at the peripheral level [3]. Major barriers identified include limited resources, insufficient access to knowledge, and structural constraints, as well as lack of motivation and capacity [35]. Other authors point to specific weaknesses: insufficient training and poor data management, lack of reliable civil registration systems for monitoring mortality, and not giving demographic [36]. As noted by Wolfe *et al.* (2021), the obstacles concern all the essential functions of the IDSR, from detection to staff training [2]. Finally, Mremi *et al.* (2021) rewrite data in sub-Saharan African incomplete untimely and of low quality, poorly analyse and misused, with a penny-use of advanced big data analytics technologies, limiting evidence-based decision-making [37].

Country experiences reveal that, despite progress in the implementation of the IDSR in Africa, many challenges remain. In Ethiopia, although 87% of sites have a surveillance officer and 95% a vaccination officer, only 44% have written terms of reference and 17% have conducted independent visits, with 34% facing vaccine stock-outs [38]. In Ghana, studies show a limited role of the community system during the Ebola outbreak, gaps in preparedness (lack of equipment, lack of isolation centres, irregular supervision) and low acceptability of the TB surveillance system [39]. In Zambia, the problems relate to human resources and coordination [26], while in Uganda, funding has fallen sharply and challenges include a lack of trained staff, irregular supervision and a high turnover rate [14]. In Nigeria, under-reporting of priority diseases remains a major problem, compounded by the lack of infrastructure and knowledge of doctors [28] [40].

In other countries, similar difficulties are emerging: in Cameroon, the old case definition of cholera was still used in 2013, with a low capacity for confirmation and a lack of structured analysis [41]; in South Africa, barriers include under-reporting, inconsistent definitions, and weak integration of environmental health [42]; in Liberia, despite post-Ebola investments, delays in sample management and lack of training persist [22] [29]. Infrastructure and communication problems are also noted: in Ethiopia and Botswana, the transmission of malaria data is considered effective [35] [43], but in other countries, such as Malawi, Kenya and Madagascar, challenges include case identification, data quality, lack of technical

guidelines and poor procedural skills [28] [33] [44]. Finally, Curran *et al.* (2015) showed that during the cholera epidemic, only 27% of facilities had rectal swabs and 11% had CaryBlair media, with 34% without reporting forms and 37% without treatment guidelines, highlighting serious coordination and management issues [45].

4. Discussion

The results of this review demonstrate that IDSR has contributed to strengthening epidemiological surveillance, improving data quality and increasing response to outbreaks in the WHO Africa region. Advances in reporting timeliness and completeness, rapid detection of outbreaks, and the adoption of digital tools confirm that the IDSR is a robust platform for integrated surveillance of priority diseases. However, these performances vary across countries and remain weakened by persistent structural challenges.

Problems related to accuracy, incompleteness and delays in reporting are recurrent. In Ghana, for example, the District Health Information Management System II improved the availability of IDSR reports in 2015, but the quality of the data reported remains insufficient and inconsistencies between weekly and monthly data need to be corrected [31]. Njuguna *et al.* (2020) pointed out that regular data quality assessments can improve their accuracy over time [25]. The under-reporting of certain diseases, documented in several contexts, raises concerns about its impact on health budgets. The inability to provide reporting forms is also a common complaint, while clinicians—patients' first contact with the health system—play a central role in reporting [3]. As Isere *et al.* have pointed out, health workers must be aware that they are an essential component of the national surveillance system [46]. The confirmation of cases also requires solid laboratories, but the networks have certainly improved but remain insufficient.

National experiences illustrate these limitations. In Sudan, the EWARN network is working relatively well and has improved detection, reporting and laboratory confirmation, but it requires more resources for communication, transport and regular supervision. More broadly, the response to epidemics requires contingency plans that can reduce the demand for services, optimize the use of existing resources, and mobilize additional resources [47]. However, a rapid and effective response depends on the availability of reliable and timely data, which requires adequate resources and a skilled workforce.

In sum, twenty-five years after its launch, the IDSR has made undeniable progress in Africa, but its sustainability and effectiveness now depend on the ability of countries to close systemic gaps. The strengthening of human and financial resources, the integration of multi-source data, the adoption of digital innovations and the consolidation of governance appear to be essential conditions for transforming the gains into a sustainable system, capable of responding to emerging and recurrent health threats.

5. Conclusion

Twenty-five years after its introduction, the IDSR has established itself as a pillar of epidemiological surveillance in Africa, with tangible advances in timeliness, comprehensiveness and response to outbreaks. Country experiences confirm that the integration of existing infrastructure, the use of digital tools and the strengthening of local capacities have led to measurable impacts on detection and response. However, persistent challenges—insufficient data quality, under-reporting of diseases, supply disruptions, weak laboratories and unstable funding—are a reminder that gains remain fragile. To transform this progress into a sustainable and resilient system, it is imperative to strengthen governance, invest in human and technological resources, and ensure regular and effective supervision. Only such an approach will enable the IDSR to fully respond to emerging and recurrent health threats and strengthen health security in the WHO Africa region.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendices

Appendix 1: Summary of Articles Included and Risk Estimated

								Risk analysis				
No.	**Author[s]**	**Title**	**IDSR?**	**Illness**	**Year**	**Country of origin**	**Article reference and nature**	**Temporal relevance (seniority)**	**Thematic alignment (IDSR)**	**Coverage and relevance of selected diseases**	**Coverage and geographic relevance**	**Risk**
0	**No Name**	**Perfect item.**	**Yes**	**Multiple**	**2026**	**Africa**	**Checks inclusion criteria = 4; Otherwise = 0**	**2026 = 4; 2020-2025 = 3; 2015-2020 = 2; 2010-2015 = 1**	**IDSR = 4, Otherwise = 1**	**Multiple = 4, Unique = 1**	**Africa = 4, One country = 1**	**0%**
1	Nnebue *et al.*	Effectiveness of data collection and information transmission process for disease notification in anambra state, Nigeria.	Yes	Multiple	2013	Nigeria	4	1	4	4	1	30%
2	Fatiregun *et al.*	Cholera outbreak in a Southwest community of Nigeria: Investigation on Risk Factors and Evaluation of a District Surveillance System.	No	Cholera	2013	Nigeria	4	1	0	1	1	65%
3	Lafond *et al.*	Notifiable disease reporting among public sector physicians in Nigeria: A cross-sectional survey to evaluate possible barriers and identify best sources of information.	Yes	Multiple	2014	Nigeria	4	1	4	4	1	30%
4	Wassilak *et al.*	Using acute flaccid paralysis surveillance as a platform for vaccine-preventable disease surveillance.	Yes	Poliomyelitis	2017	Nigeria	4	2	4	1	1	40%
5	Nass *et al.*	Verification of neonatal tetanus surveillance systems in Katsina State, Nigeria.	Yes	Neonatal tetanus	2017	Nigeria	4	2	4	1	1	40%
6	Jinadu *et al.*	Integrated disease surveillance and response strategy for epidemic prone diseases at the primary health care [PHC] level in Oyo State, Nigeria.	Yes	Multiple	2018	Nigeria	4	2	4	4	1	25%
7	Uchenna *et al.*	An Evaluation of the Integrated Disease Surveillance and Response [IDSR] in Enugu State, Nigeria.	Yes	Multiple	2018	Nigeria	4	2	4	4	1	25%
8	Wolfe *et al.*	Systematic review of integrated disease surveillance and response [IDSR] implementation in the African region.	Yes	Multiple	2021	Africa	4	3	4	4	4	5%
9	World Health Organization	Technical guidelines for integrated disease surveillance and Response in the African Region.	Yes	Multiple	2010	Africa	4	4	4	4	4	0%
10	Fall *et al.*	Integrated Disease Surveillance Quarterly Bulletin—1st Semester 2016.	Yes	Multiple	2019	Africa	4	2	4	4	4	10%

Continued

11	Poy *et al.*	Polio eradication initiative contribution in strengthening immunization and integrated disease surveillance data management in WHO African region.	Yes	Poliomyelitis	2016	Africa	4	2	4	1	4	25%
12	Mwengee *et al.*	Polio Eradication Initiative: Contribution to improved communicable diseases surveillance in WHO African region.	Yes	Poliomyelitis	2016	Africa	4	2	4	1	4	25%
13	Mbondji *et al.*	Health information systems in Africa: Descriptive analysis of data sources, information products and health statistics.	No	Multiple	2014	Congo	4	1	0	4	1	50%
14	Nsubuga *et al.*	Positive predictive value and effectiveness of measles case-based surveillance in Uganda.	Yes	Measles	2017	Uganda	4	2	4	1	1	40%
15	Lukwago *et al.*	The implementation of integrated disease surveillance and response in Uganda: A review of progress and challenges between 2001 and 2007.	Yes	Multiple	2013	Uganda	4	1	4	4	1	30%
16	Borchert *et al.*	Rapidly Building Global Health Security Capacity—Uganda Demonstration Project.	No	Multiple	2014	Uganda	4	1	0	4	1	50%
17	Nakiire *et al.*	Healthcare workers' experiences regarding scaling up of training on integrated disease surveillance and response (IDSR) in Uganda, 2016: cross sectional qualitative study.	Yes	Multiple	2019	Uganda	4	2	4	4	1	25%
18	Masiira *et al.*	Evaluation of integrated disease surveillance and response [IDSR] core and support functions after the revitalization of IDSR in Uganda from 2012 to 2016.	Yes	Multiple	2019	Uganda	4	2	4	4	1	25%
19	Issah *et al.*	Assessment of the usefulness of integrated disease surveillance and response on suspected ebola cases in the brong Ahafo region, Ghana.	Yes	Ebola	2015	Ghana	4	1	4	1	1	45%
20	Adokiya *et al.*	The integrated disease surveillance and response system in northern Ghana: Challenges to the core and support functions.	Yes	Multiple	2015	Ghana	4	1	4	4	1	30%
21	Adokiya and Awoonor-Williams	Ebola virus disease surveillance and response preparedness in northern Ghana.	Yes	Ebola	2016	Ghana	4	2	4	1	1	40%

Continued

22	Adokiya *et al.*	Evaluation of the reporting completeness and timeliness of the integrated disease surveillance and response system in northern Ghana.	Yes	Multiple	2016	Ghana	4	2	4	4	1	25%
23	Frimpong-Mansoh *et al.*	Evaluation of the tuberculosis surveillance system in the Ashaiman municipality, in Ghana.	No	Tuberculosis	2018	Ghana	4	2	0	1	1	60%
24	Nagbe *et al.*	Integrated disease surveillance and response implementation in liberia, findings from a data quality audit.	Yes	Multiple	2019	Liberia	4	2	4	4	1	25%
25	Hambliona *et al.*	The challenges of detecting and responding to a Lassa fever outbreak in an Ebola-affected setting.	Yes	Lassa and Ebola	2018	Liberia	4	2	4	1	1	40%
26	Nagbe *et al.*	The implementation of integrated disease surveillance and response in Liberia after ebola virus disease outbreak 2015-2017.	Yes	Ebola	2019	Liberia	4	2	4	1	1	40%
27	Curran *et al.*	Systems, supplies, and staff: A mixed-methods study of health care workers' experiences and health facility preparedness during a large national cholera outbreak, Kenya 2015.	Yes	Cholera	2018	Kenya	4	1	4	1	1	45%
28	Mwatondo *et al.*	Factors associated with adequate weekly reporting for disease surveillance data among health facilities in Nairobi County, Kenya, 2013.	Yes	Multiple	2016	Kenya	4	2	4	4	1	25%
29	Mutsigiri-Murewanhema *et al.*	Evaluation of the maternal mortality surveillance system in mutare district, Zimbabwe, 2014-2015: A cross-sectional study.	No	Maternal mortality	2017	Zimbabwe	4	2	0	1	1	60%
30	Muchena *et al.*	Factors associated with contracting malaria in ward 29 of Shamva district, Zimbabwe, 2014.	No	Malaria	2017	Zimbabwe	4	2	0	1	1	60%
31	Kebede *et al.*	Establishing a national influenza sentinel surveillance system in a limited resource setting, experience of Sierra Leone.	Yes	Flu	2013	Sierra Leone	4	1	4	1	1	45%
32	Njuguna *et al.*	Revitalization of integrated disease surveillance and response in Sierra Leone post Ebola virus disease outbreak.	Yes	Ebola	2019	Sierra Leone	4	2	4	1	1	40%
33	Jima *et al.*	Analysis of malaria surveillance data in Ethiopia: What can be learned from the Integrated Disease Surveillance and Response System?	Yes	Malaria	2012	Ethiopia	4	1	4	1	1	45%

Continued

34	Lakew *et al.*	Status of surveillance and routine immunization performances in Amhara Region, Ethiopia: findings from in-depth peer review.	No	Vaccination	2017	Ethiopia	4	2	0	1	1	60%
35	Ashbaugh *et al.*	Detecting Ebola with limited laboratory access in the Democratic Republic of Congo: evaluation of a clinical passive surveillance reporting system.	Yes	Ebola	2017	Congo	4	2	4	1	1	40%
36	Benedetti *et al.*	Sparks creating light? Strengthening peripheral disease surveillance in the Democratic Republic of Congo.	Yes	Peripheral diseases	2016	Congo	4	2	4	1	1	40%
37	Nguku *et al.*	Field epidemiology and laboratory training programs have been in Africa for 10 years, what is their effect on laboratory-based surveillance? Reflections from a panel at the african society of laboratory medicine December 2014 Cape Town meeting.	Yes	Multiple	2015	South Africa	4	1	4	4	1	30%
38	Ngwa *et al.*	Cholera public health surveillance in the Republic of Cameroon-opportunities and challenges.	Yes	Cholera	2016	Cameroon	4	2	4	1	1	40%
39	Wu *et al.*	Integrated disease surveillance and response [IDSR] in Malawi: Implementation gaps and challenges for timely alert.	Yes	Multiple	2018	Malawi	4	2	4	4	1	25%
40	Mremi *et al.*	Twenty years of integrated disease surveillance and response in Sub-Saharan Africa: challenges and opportunities for effective management of infectious disease epidemics. One Health Outlook.	Yes	Multiple	2021	Tanzani	4	3	4	4	1	20%
41	Mandyata *et al.*	Challenges of implementing the integrated disease surveillance and response strategy in Zambia: A health worker perspective. BMC Public Health.	Yes	Multiple	2017	Zambia	4	2	4	4	1	25%
42	Randriamiarana *et al.*	Evaluation of the reinforced integrated disease surveillance and response strategy using short message service data transmission in two southern regions of Madagascar.	Yes	Multiple	2018	Madagascar	4	2	4	4	1	25%
43	Motlaleng *et al.*	Driving towards malaria elimination in Botswana by 2018: progress on case-based surveillance, 2013-2014.	Yes	Malaria	2016	Botswana	4	2	4	1	1	40%

Continued

44	World Health Organization	Protocol for the assessment of national communicable disease surveillance and response systems.	No	Multiple	2021	Mali	4	3	0	4	1	40%
45	Moumoun *et al.*	Seroprevalence in Niger from 2005 to 2019: estimates from the epidemiological surveillance of measles.	No	Rubella	2021	Niger	4	3	0	1	1	55%
46	Baldé	Response to the Ebola epidemics in Guinea: Public Health Organisational issues and possible solutions.	Yes	Ebola	2015	Guinea	4	1	4	1	1	45%
47	Ouedraogo	Epidemiological surveillance system in Burkina Faso: Contribution to the implementation of a computerized system for reporting malaria data and geoepidemiological analyses for decision-making.	No	Malaria	2018	Burkina Faso	4	2	0	1	1	60%
48	Mongbo *et al.*	Evaluation of the performance of integrated disease surveillance and response in the Ouidah-Kpomassè-Tori-Bossito health zone, Benin.	Yes	Multiple	2024	Benin	4	3	4	4	1	20%
49	Malebana *et al.*	Communicable Disease Surveillance in South Africa and LMICs: A Systematic Review of Systems, Challenges, and Integration with Environmental Health.	Yes	Multiple	2025	South Africa	4	3	4	4	1	20%
50	Jean Louis *et al.*	Strengthening Outbreak Detection in Africa to Achieve the 7-1-7 Global Framework: Challenges and Opportunities.	Yes	Multiple	2025	Africa Region	4	3	4	4	1	20%
51	Kambalame *et al.*	Barriers and facilitators to the implementation of integrated disease surveillance and response [IDSR] in Africa: a systematic review using the consolidated framework for implementation research [CFIR]. Front Public Health.	Yes	Multiple	2026	Africa Region	4	4	4	4	1	15%

Appendix 2: Summary of Results by Problems, Limitations/Difficulties and Suggestions

Issue	Limitations and challenges	Suggestion
Data accuracy [incomplete data and delays in reporting]	- **Under-reporting of cases**: mild symptoms, lack of medical research or gaps in surveillance systems. - **Late case detection**: Delays in screening and atypical presentation of symptoms. - **Diagnostic error**: Poor classification of cases. - **Variability in reporting practices**: Difficulty in comparing data between different regions or time periods. - **Lack of data harmonization**: Difficulty in analysing data.	Make a good interpretation of weekly and monthly data while taking into account uncertainties when analysing results.
Under-reporting [notification] of certain diseases	- **Under estimation of the magnitude of the epidemic**: Estimates of the magnitude of the epidemic; potential to distort estimates of disease incidence and prevalence. - **Challenges in early detection of outbreaks**: Spread of the disease. - **Difficulties in health resource planning**: Underestimation. - **Bias in epidemiological studies**: Adjust estimates of associations between risk factors and disease. - **Misallocation of resources**	Take steps to improve case detection and reporting to ensure effective epidemiological surveillance.
Lack of knowledge of case definitions, staff terms of reference, monitoring procedures.	- **Inconsistent interpretation of cases**: Variations in the way cases are identified, reported and classified. - **Limited comparability of data**: Compromise of ability to detect epidemics effectively. - **Bias in estimating disease incidence and prevalence**: False estimates of burden of disease. - **Difficulties in detecting disease outbreaks**: Misinterpretation.	Promote clear standards and guidelines for case definitions to improve disease surveillance and understanding.
Lack of documentation on preparedness and response plans	- **Delays in responding to outbreaks**: Lack of procedures, more time to implement effective surveillance and control measures. - **Lack of coordination among stakeholders**: Gaps in data collection and analysis. - **Difficulty in assessing the effectiveness of interventions**: Difficulty in identifying the best and most effective strategies. - **Increased risk of disease spread**: Wide spread of disease. - **Non-compliance with international standards and guidelines**: Potential to affect countries 'ability to collaborate effectively with other nations to prevent and control transboundary diseases.	Compromising the ability to respond effectively to outbreaks.
Insufficient financial resources; material [computers, photocopiers, printers] and logistics [transport vehicles, etc.]	- **Qualified Personnel Staff**: Skilled Personnel: Experts in epidemiology, data analysis and public health. - **Inadequate infrastructure and equipment**: Lack of appropriate laboratory equipment, computer systems and software. - **Limited geographical coverage**: Lack of disease detection and reporting in some areas, which compromises the ability to prevent the spread of disease. - **Weak emergency response capacity**: Delays in implementing prevention and control measures. - **Difficulty in maintaining existing surveillance systems**: Gradual deterioration of existing systems. - **Increased risk of under-reporting of diseases**: Adequate means to properly detect, diagnose and report cases. - **Impact on data quality**: Less reliable data collection methods to verify and validate data.	Detecting, preventing and controlling diseases in order to have a significant impact on public health.

Continued

Poor record keeping during desk reviews made it difficult to retrieve data	- **Poor data maintenance**: Compromise of the reliability of epidemiological data at the risk of distorting analyses and conclusions. - **Difficulties in analysis**: Delays and errors in the process. - **Misinterpretation**: Incorrect conclusions about disease prevalence, spread, or trends. - **Tracking difficulties**: Compromised capacity to take timely and effective action. - **Difficulties in planning and decision-making**: Difficulty in effectively allocating resources and implementing disease prevention and control strategies.	Compromising data quality, reliable analysis, disease tracking ability.
Lack of availability of forms	- **Incomplete data collection**: Gaps in the understanding of diseases and epidemiological trends, making it difficult to accurately assess public health risks. - **Data variability**: Variability in data collected at the regional, national or international level. - **Difficulties in analysis and interpretation**: Difficulties in grouping, filtering and analysing data in a consistent manner. - **Risk of underreporting**: Increased risk of under-reporting of cases and consequently delay in detection of disease outbreaks. - **Impact on data quality**: Reduced data quality due to the collection of inconsistent or irrelevant information. - **Administrative complexity**: Delays in the transmission of information and inefficiency in data management.	Ensure the availability of forms adapted to epidemiological surveillance needs.