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Conceptualisation and implementation of integrated disease surveillance globally: a scoping review

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ABSTRACT

Objectives: The objective of this study was to examine the conceptualisation and operationalisation of Integrated Disease Surveillance (IDS) systems globally and the evidence for their effectiveness. Furthermore, to determine whether the recommendations made by Morgan et al. are supported by the evidence and what the evidence is to inform country development of IDS.
Study design: The study incorporated a scoping review.
Methods: This review summarised evidence meeting the following inclusion criteria: *Participants*: any health sector; *Concept*: IDS; and *Context*: global. We searched Medline, Embase, and Epistemonikos for English publications between 1998 and 2022. Standard review methods were applied. A bespoke conceptual framework guided the narrative analysis. This scoping review is part of a research programme with three key elements, with the other studies being a survey of the International Association of National Public Health Institutes members on the current status of their disease surveillance systems and a deeper analysis and case studies of the surveillance systems in seven countries, to highlight the opportunities and challenges of integration.
Results: Eight reviews and five primary studies, which were assessed as being of low quality, were included, mostly examining IDS in Africa, the human sector, and communicable diseases. None reported on the effects on disease control or on the evolution of IDS during the COVID-19 pandemic. Descriptions of IDS and of integration varied. Prerequisites of effective IDS systems mostly related to the adequacy of core functions and resourcing requirements. Laws or regulations supporting system integration and data sharing were not addressed. The provision of core functions and resourcing requirements were described as inadequate, financing as non-sustainable, and governance as poor. Enablers included active data sharing, close cooperation between agencies, clear reporting channels, integration of vertical programs, increased staff training, and adopting mobile reporting. Whilst the conceptual framework for IDS and Morgan et al.'s proposed principles were to some extent reflected in the highlighted priorities for IDS in the literature, the evidence base remains weak.
Conclusions: Available evidence is fragmented, incomplete, and of poor quality. The review found a lack of robust evaluation studies on the impact of IDS on disease control. Whilst a lack of evidence does not imply a lack of benefit or effect, it should signal the need to evaluate the process and impact of integration in the future development of surveillance systems. A common IDS definition and articulation of the parts that constitute an IDS system are needed. Further robust impact evaluations, as well as country reviews and evaluations of their IDS systems, are required to improve the evidence base.

Introduction

Following the re-emergence of large outbreaks of infectious diseases in West Africa, the World Health Organization (WHO) African Region in 1998 devised and adopted the Integrated Disease

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Surveillance (IDS) strategy,[1–3] which aimed to support countries improve their capabilities to detect and respond to communicable disease threats in a timely manner.[1] However, weaknesses in surveillance systems globally were glaringly exposed by the COVID19 pandemic.[4]

It has been proposed that integrating separate disease surveillance systems would strengthen national disease surveillance.[5] Whilst strong arguments for greater integration of disease surveillance systems have been made, the evidence base to support integration has not yet been clearly established. Even though there is some evidence, based on limited data and/or expert opinion[6,7] suggesting beneficial effects of integrating human and animal surveillance, there is at present no evidence for the effects and potential cost-savings for the type of fully interconnected IDS system described by Morgan et al.

In many countries National Public Health Institutions (NPHIs) play an important role in the organization of national disease surveillance, and the International Association of National Public Health Institutes (IANPHI) was funded by the Bill and Melinda Gates Foundation to examine the status of national surveillance systems, the extent to which IDS systems have been developed and operationalised, and the evidence base for the effectiveness of IDS. This scoping review is part of this research programme with three key elements, with the other studies being a survey of IANPHI members on the current status of their disease surveillance systems and a deeper analysis and case studies of the surveillance systems in seven countries, to highlight the opportunities and challenges of integration.

The aim of this scoping review was to document the current state of the evidence and approaches to the conceptualisation and operationalisation of IDS globally. Furthermore, to determine whether the recommendations made by Morgan et al. are supported by the evidence and what the evidence is to inform country development of IDS, we sought to answer the following research questions:

1. How is IDS defined and described in the literature and how has IDS evolved over the course of the COVID-19 pandemic?
2. What are the key features and prerequisites of effective IDS systems?
3. What are the challenges and enablers/opportunities for IDS development?

Methods

This scoping review[8] explores the current state of IDS implementation globally and opportunities for improvement. This methodology is a suitable approach to address explorative research questions[8] such as those posed by this review. This work followed the scoping review framework proposed by Arksey and O'Malley[9] and the PRISMA ScR extension.[10] The protocol was also registered with the Open Science Framework (https://osf.io/bfh7q/wiki/home/https://osf.io/bfh7q/wiki/home/).

Eligibility criteria

We used the Population/Concept/Context framework[11] to describe our inclusion criteria: Population: any health sector (human/animal/both), irrespective of discipline; Concept: IDS regardless of definition used. Components of IDS, such as community-based (CBS), event-based (EBS), or vertical disease surveillance, were only included if the focus was on the integration into the overall system; Context: global; type of sources: reviews and primary studies not included in reviews. We excluded protocols and IDS technical guidelines from Ministries of Health or WHO, editorials, and studies not mentioning IDS in the abstract. Due to the short project timeframe, we focussed on summarised evidence published in English.

Search strategy

The electronic database search for relevant literature was conducted in four steps: 1. PubMed: preliminary search to identify relevant publications and search terms to inform the search strategy; 2. Medline and Embase: main search for review articles published between 1998 (when WHO Africa adopted the Integrated Disease Surveillance and Response [IDSR] strategy) and 12 May 2022 (See Supplementary File 1); 3. Epistemonikos (2 June 2022): to capture recent primary studies not included in reviews; 4. Medline and Embase (9 June 2022): to identify recent primary studies of IDS during the COVID-19 pandemic if no reviews on the topic was identified in preliminary searches. Other sources such as web portals of selected key organisations (as of 2 June 2022) including WHO, US Centres for Disease Control and Prevention, and Médecins Sans Frontières were also searched.

Data management and analysis

All identified citations were imported into EndNote (v X9, Clarivate) and de-duplicated. Screening of titles and abstracts using Rayyan[12] was conducted by two reviewers independently. Potentially relevant articles were retrieved and assessed in duplicate. Disagreements were resolved through discussion or by arbitration. A matrix of primary studies was produced to visualise the overlap between reviews. A PRISMA flow chart[13] was used to document the selection process (Fig. 2). Data extraction, using templates developed and piloted for this review, was conducted by one reviewer, with a second reviewer checking the accuracy of the extracted data. The following data were extracted: author, year of publication, type of review (or study), objectives, search strategy, the number of databases searched and search limitations, the number of included studies, numbers and names of countries, IDS definition, IDS features and prerequisites, details on system types included in the IDS, challenges and opportunities of IDS implementation, changes made to the IDS during the COVID19 pandemic, and information on funding and conflict of interest.

Findings of included studies were analysed using narrative synthesis.[14–16] A bespoke conceptual framework (Fig. 1), based on the initial WHO IDSR framework[3] and incorporating Morgan et al.'s (2021) proposed principles for IDS[5] was devised to guide the data synthesis and identify emerging themes. Regardless of surveillance type, the framework considers the integrated vision of an IDS system from an organisational and operational perspective, comprising five key domains: 1) governance, 2) system and structure, 3) financing, 4) core functions, and 5) resourcing requirements.

Quality assessment

Quality assessment was conducted by two reviewers independently. Since no standardised quality assessment tool for narrative mixed studies reviews could be identified, a set of 13 criteria for this purpose were devised based on the AMSTAR 2 tool.[17] The Mixed Methods Appraisal Tool[18] was used to assess the quality of included primary studies. Disagreements were resolved through discussion.

Results

The main search in Medline and Embase retrieved 3032 citations, of which 464 were removed before screening, and 2513 were

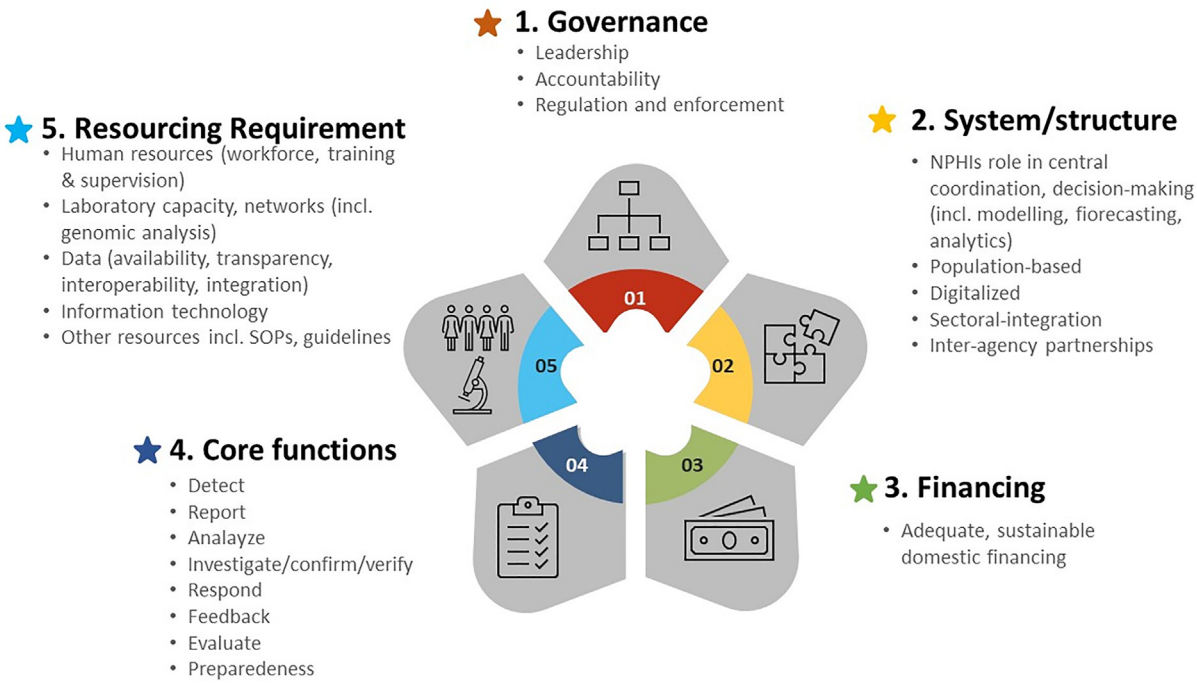

Fig. 1. Conceptual framework for the review.

excluded at title and abstract stage, leaving 55 potentially eligible citations for full-text scrutiny (Fig. 2). Eight of these were included,[19–26] and 47 were excluded with reasons (Supplementary File 2). Additional searches in Epistemonikos, Medline, Embase, and grey literature identified five eligible primary studies.

The included articles were published between 2009 and 2021. Five of the eight reviews were narrative systematic mixed studies reviews, two were literature reviews, and one was a systematic scoping review. The five primary studies comprised a mix of qualitative, quantitative, and mixed-methods studies. Only two reviews had assessed the quality of included studies. The articles, which focussed mostly on IDS systems in the WHO African Region, human sector surveillance, and communicable diseases, were heterogenous in terms of aims, and scope (See Supplementary File 3 for description of the general characteristics of included articles.) We summarise in following the evidence related to our research questions and describe emerging themes identified using the bespoke conceptual framework (See Supplementary File 4).

RQ-1: How is IDS defined and described in the literature and how has this evolved over the course of the COVID-19 pandemic?

One article provided a definition of IDS,[22] whereas the others provided various descriptions of the intent, aims, scope, or goal of IDS, while highlighting different aspects of the system.

Two reviews[21,23] and three primary studies[27–29] described the use of IDS to improve countries' surveillance systems and responses. Two reviews[21,26] indicated that the IDS strategy should include all levels of the health system, whilst one review[20] described it operating at district level. Three reviews[20,22,23] described the use of IDS to integrate surveillance systems and databases. One review[22] described 'multiple diseases or behaviours of interest' as the focus of IDS, while another focused on 'priority diseases.'[26]

One primary study[30] discussed use of IDS to "implement a coordinated and integrated approach" to surveillance. Three studies[27,28,30] included the improvement of data usability. Three studies reported various targets of data collection: 'primary causes of mortality and morbidity',[27] 'illnesses and disease outbreaks',[28] and 'priority communicable diseases'.[30] No article addressed streamlining of processes or the use of standardised tools in their descriptions of IDS.

The description of the concept of integration varied in terms of degree of integration, when in the surveillance process it occurs, and what type of data, sectors, structures, processes and personnel that are integrated, and the form it takes.[19,20,23,24,28,29,31]

No article described the evolution of IDS systems during the COVID-19 pandemic.

RQ-2: What are the key features and pre-requisites of effective IDS systems?

Governance

We found limited information on the pre-requisites of effective IDS governance. What was reported included the involvement of all health facilities,[27] having leadership in place at both central and peripheral levels,[22] and government commitment to IDS implementation.[30]

System and structure

Key system and structural features, highlighted across multiple articles, were digitisation and electronic reporting systems to minimise costs,[21] improving timeliness and data quality,[24] strong coordination and communication between sectors, an organisational structure that can accommodate both vertical, horizontal,[19,22] and two-directional information flow,[24] and sufficient system flexibility to respond to new challenges. Furthermore, it should contain both indicator based surveillance (IBS) and EBS, integrate data from multiple sources,[20] and provide good interconnectivity, interoperability, semantic consistency, and convergence across sectors.[19]

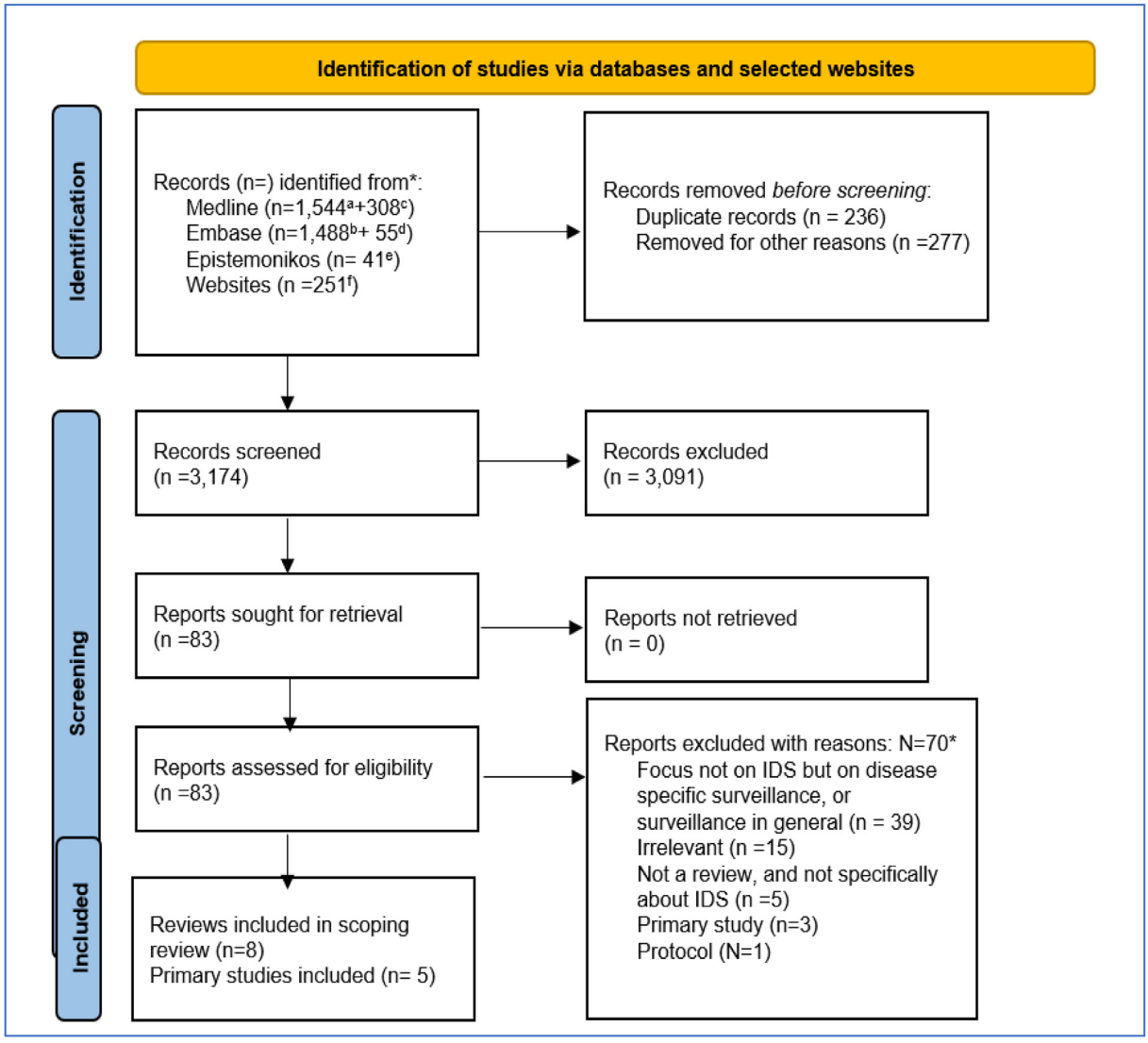

Fig. 2. PRISMA study flow chart describing the study selection process
*Six of these studies are not listed among the excluded studies as they were included in reviews. a. Main Medline search (reviews); b. Main Embase search (reviews); c. Additional Medline search (primary IDS/COVID-19 studies); d. Additional Embase search (primary IDS/COVID-19 studies); e. Epistemonikos search (primary studies not included in reviews); f. Selected key organizations' web-portals (grey literature).
Abbreviations: IDS = Integrated Disease Surveillance; PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Financing

Few articles[19,21,26,29] addressed financial aspects. The overall theme was the need for adequate, integrated, and sustained funding for an effective IDS system. Domestic financing and ownership were not discussed.

Core functions

Data collection was the common theme that emerged across included articles. Data needed to be timely, standardised, complete, comparable, accurate, and transparent. Data collection should include informal and formal sources for timely detection of outbreaks and be collated in a consistent way that allows effective data analysis. The coordination of case definition reporting protocols across programmes improves completeness.[20] Effective case confirmation data require prompt and improved specimen collection and handling, strong case confirmation capacity, quality surveillance reporting, and improved documentation. IDS systems needed to be evaluated on a routine basis[24] and require enhanced feedback mechanisms throughout the system.[21] Good information on prior risks is required to inform outbreak preparedness response plans.[20]

Resourcing requirements

Most articles highlighted the importance of resourcing requirements for effective IDS systems, such as having sufficient human resources with enhanced training,[19–21,26–28] enhanced laboratory facilities and capacity, updated infrastructure (including IT systems, records databases, supporting technology), and data management tools.[26] Also highlighted were standardisation, including clear standard operating procedures (SOP),[19] protocols and training materials,[21] and availability of all tools across all levels.[27] (see Table 1)

Table 1
Overview of reviews and primary studies reporting features and prerequisites of effective IDS systems.

Author Year	Country/Region	Governance	System/structure	Financing	Core functions	Resourcing requirement
Reviews						
George et al., 2020[19]	Worldwide		√	√		√
Mremi et al., 2021[20]	Sub-Saharan Africa		√		√	√
Ng'etich et al., 2021[21]	Africa		√	√	√	√
Phalkey et al., 2013[22]	LMIC	√	√			
Pilot et al., 2019[23]	India				√	√
Sahal et al., 2009[24]	Worldwide		√		√	√
Wendt et al., 2013[25]	Worldwide		√		√	√
Wolfe et al., 2021[26]	Africa		√	√		√
Primary studies						
Abuzerr et al., 2021[31]	Palestine	√				
Ibrahim et al., 2020[27]	Nigeria	√				√
Kebede et al., 2010[30]	Africa	√				
Omondi et al., 2020[28]	Kenya					√
Saleh et al., 2021[29]	Tanzania			√		

Abbreviations: IDS = Integrated Disease Surveillance; LMIC = low- or middle-income country.

RQ-3: What are the identified challenges to and enablers/ opportunities of IDS development?

Governance

Lack of regulation, coordination,[22] and law enforcement[23] were reported as impediments to a functional IDS system, as well as poor leadership and governance.[31] One review[23] identified active sharing of reports across programmes, and close cooperation with IDS agencies, as opportunities that could streamline procedures and reduce inefficiencies.

System/structure

System/structure challenges reported were related to poor or inadequate sector integration and coordination of vertical programmes[22,23] and health structures[23] and parallel data collection causing overburdening of staff.[26] Other challenges included the exclusion of non-communicable diseases, weak district-level infrastructure,[22] weak health systems overall,[30] and poor involvement of private[22,23] and public health sectors.[23,27] Disparate data that limited system integration[25] and the underuse of healthcare and non-healthcare data,[20] were also mentioned as challenges. Frequent changes in procedures and reporting formats,[19,23] as well as a lack of policy coherence[31] had a negative impact.

Various enablers were reported. Systems integration may improve data quality and timeliness,[19] reduce redundancies, improve effectiveness, and enable earlier identification of outbreaks.[23,26] Including CBS in the IDS system may strengthen early detection and reporting capabilities.[20,21] Weekly reporting forms may help increasing surveillance reports.[21] Analysis of surveillance data, close monitoring of performance indicators at regional levels, and routine surveillance system performance monitoring may improve data accuracy.[21]

Financing

Financing was reported as non-sustainable and a major challenge.[19,21–23,26,31] One review[23] reported a strong reliance on 'out-of-pocket' expenditure as a challenge to IDS. No reviews discussed opportunities or enablers of adequate financing.

Core functions

Operationalisation of IDS core functions was overall deemed to be inadequate. Low use of standardised case definitions[20–22,27] and low motivation among healthcare workers for surveillance[20,29] were frequently reported challenges. Poor data quality, paper-based reporting,[20–22] and other reporting issues[23,26,28,30] were consistent themes across reviews. Poor data management, limited capacity for analysis, and poor analytical skills[20–22,27] hampered effective analysis. Weak diagnostic laboratory capabilities,[26] particularly at local facilities, also hampered local investigations and confirmation of disease.[22] There was limited generation of reliable health information,[27] and poor use of surveillance data for decision-making.[22,27] Inadequate and/or erratic feedback,[21,22,26] especially at the peripheral levels,[21] was another challenge.

Resourcing requirements

The resourcing of IDS was deemed inadequate overall, with challenges especially related to lack of designated skilled personnel, inadequate training, and high staff turnover at the peripheries.[19–22,26] Limited supervision from the next level-up[26,27] and lack of supervision especially at the district level were the other challenges.[21,22] Limited laboratory capacity[19–22,26,30] and a lack of functional laboratory networks[22,26] were other major challenges. Lack of laboratory equipment, limited storage,[20,22] and transport facilities were particularly challenging at the periphery.[20,22,26,27]

Enablers that improved adequacy of reporting and reduced workload were increasing the number of trained staff and employing a designated focal surveillance person.[21,26] Other enablers included incorporating surveillance activities into job descriptions, training conducted through initial pre-service curricula, induction and on-the-job training at all levels. Supervisory visits, sensitisation meetings, increased awareness of the benefits of supervision, and strict adherence to planned surveillance schedules were also useful enablers.[21] Other enablers[20,21] were the use of electronic reporting systems, mobile technologies, and strengthening of health information systems (see Table 2).

Quality assessment

Three of the included reviews were judged to be of *low* quality overall,[19,21,26] and five were of *critically low* quality. For two of the primary studies,[28,31] 80% of the quality criteria were met, whereas for the other three, none of the criteria were met (Supplementary file 5).

Discussion

Eight reviews and five primary studies, published between 2009 and 2021, were included in this scoping review on the

Table 2
Overview of reviews and primary studies reporting challenges to and enablers of IDS systems.

Author Year	Country/Region	Governance	System/structure	Financing	Core functions	Resourcing requirement
Reviews						
George et al., 2020[19]	Worldwide		C/E	C	C	C
Mremi et al., 2021[20]	Sub-Saharan Africa		E		C/E	C/E
Ng'etich et al., 2021[21]	Africa		E	C	C/E	C/E
Phalkey et al., 2013[22]	LMIC	C	C	C	C	C
Pilot et al., 2019[23]	India	C	C/E	C	C	E
Sahal et al., 2009[24]	Worldwide		E			
Wendt et al., 2013[25]	Worldwide		C/E		C/E	C
Wolfe et al., 2021[26]	Africa		C/E	C	C	C/E
Primary studies						
Abuzerr et al., 2021[31]	Palestine	C	C	C	C	C
Ibrahim et al., 2020[27]	Nigeria		C		C	C
Kebede et al., 2010[30]	Africa		C		C	C
Omondi et al., 2020[28]	Kenya					C
Saleh et al., 2021[29]	Tanzania			C		C

Abbreviations: C = challenges; E = enablers; IDS = Integrated Disease Surveillance; LMIC = low- or middle-income country.

conceptualisation and operationalisation of IDS systems globally. Most articles focussed on IDS in the WHO African Region, human sector surveillance, and communicable diseases. A key evidence gap identified was the fact that there are no studies that reported on the effectiveness of IDS for disease control outcomes. The quality of the included evidence was *low* to *critically low*. The diversity of interpretation of IDS suggests the lack of a common definition and of an articulated understanding of the nature of IDS and the parts that constitute the system. Moreover, the description of 'integration' varied, and it was typically not explicit what was integrated in the IDS systems under study. We identified no articles that reported on changes to the IDS system triggered by the COVID-19 pandemic.[32] However, due to recency of the pandemic, changes to IDS may yet have to be evaluated and published.

The conceptual framework and Morgan et al.'s proposed principles for IDS systems[5] were to some extent reflected by the highlighted priorities for IDS in the literature. Consistently reported pre-requisites for effective IDS systems were the adequacy of core surveillance functions and resourcing requirements, including human resources, laboratory capacity, digitisation, and electronic reporting. Although our framework underscores the importance of governance (e.g., leadership, laws, regulation and enforcement), system and structure (e.g., NPHI's role in surveillance coordination and decision-making, population representativeness, use of digital technology including operability of systems, and sectoral integration), and adequacy of financing, these factors were rarely discussed in the included reviews, neither was integration of non-healthcare data, pathogen-sequencing capacity, sources of funding or ownership of IDS systems. Comparably more challenges were reported than enablers or opportunities for IDS implementation in the included reviews. The core functions and resourcing requirements were described as overall inadequate and a main challenge, particularly at the district and local levels. Financing was described as inadequate and non-sustainable and governance as poor. From statements on the progress and status of IDS made in the included articles, it is evident that while there have been some improvements in processes over time, the functioning of current IDS systems is mostly suboptimal.

The included articles did not discriminate between data from EBS or IBS systems, nor did they detail pre-requisites or challenges specific to these different types of surveillance, or described the tools or frameworks used for monitoring or evaluation. They also considered the IDS system in isolation to other external factors, such as the potential impact of donor funding of specific disease control programs, or other programs. There was an overall lack of detail describing the functioning of the IDS system in terms of coordination, communication, leadership, regulation, and accountability in the included reviews. It was therefore not clear from what contextual factors and mechanisms lead to the observed outcomes. It was also unclear as to how IDS was used by stakeholders to effect change and inform disease control responses. It was not possible to ascertain the criticality of the various components proposed in the framework or any co-dependencies and synergies between components.

Limitations

The main search was restricted to articles in English and was only conducted in two major databases and three selected grey literature sources. The review mainly focussed on evidence summaries, therefore, relied on the specific aims and quality of the reported outcomes within these articles. The overall low to critically low quality of the included reviews and primary studies with limited representativeness needs to be considered in further interpretations and generalisation of the results. The majority of included articles included some results based on subjective responses, potentially introducing bias. Finally, the focus of this review was mostly limited to the surveillance aspect of IDS and not the response element described in IDSR.

Implications for practice and policy

The findings from the reviews to varying degrees support the conceptual framework for IDS devised for this review and affirm the need for good governance structure and charter, implementation of a functional system and structure for disease surveillance, and adequate resourcing. However, the low to critically low quality of the included body of evidence prevents us from drawing any strong recommendations for practice or policy. Nevertheless, some factors that were consistently reported across the included articles as important for a well-functioning IDS system are worth mentioning: e.g., the need for ample staffing with appropriate skill mix and training, increased laboratory capacity, digitisation, and digitised reporting, as well as various components needed to deliver the core functions such as standardised case definitions, protocols, and guidance. These factors are likely to be some of the key building blocks for IDS systems.

The various interpretations of the concept of IDS in the included articles may in part reflect differing national needs and priorities, which may result in variations in the operationalisation of IDS across countries, and therefore, a need for a flexible IDS system. It is not clear from the results of this scoping review how much integration is optimal in terms of cost, effectiveness, and resources,

what should be integrated and how, and what key factors should be considered when integrating systems. Systematic evaluations of IDS systems are needed, using empirical data to fully understand the process of integration and its impact to maximise benefits and minimise potential adverse effects (e.g., overworked health workers, over-stretching limited shared resources, and units and programs not benefitting from integration) and how best to operationalise IDS in different settings.

Implications for research

For future success, it is vital to demonstrate measurable benefits of IDS systems to stakeholders. Since available research is inadequate, robust evaluations of the effectiveness of current IDS systems are necessary. Future studies should aim to assess the effect of IDS on disease control, saved lives, and costs, using a standardised evaluation framework, which can be adapted to different contexts, and should also follow available reporting standards. In addition, registering a protocol with pre-specified aims and methods may also increase the rigour of the research.

Countries should be encouraged to evaluate their IDS systems, and all new IDS efforts should, as a minimum, have a basic operations research capacity in place to ensure that what is undertaken is actually made to work.[33] Other potential areas for research include the effects of legislation on reporting adherence, role of funding sources and research into monitoring tools, and assessment frameworks. In addition, the quality of included reviews was generally poorly suited to answering the review questions. A future high-quality systematic review, perhaps using a realist synthesis approach, may better examine the effect of context and the mechanisms that lead to the outcomes observed. Conducting in-depth case studies of effective IDS systems is another option. To understand how IDS functions in pandemics, further research is also needed to capture the experiences with IDS during COVID-19 and changes made in response to the pandemic.

Conclusion

The existing evidence for IDS conceptualisation and operationalisation is fragmented and incomplete, and the included quality of evidence is poor. The review also found a lack of robust evaluation studies on the impact of IDS on disease control. However, whilst a lack of evidence does not imply a lack of benefit or effect, it should signal the need to evaluate the process and impact of integration in the future development of surveillance systems. Sharing of insights between countries on a similar implementation journey would be of mutual benefit. An articulated and shared understanding of the nature of IDS is necessary to enable comparisons between countries and to evaluate their implementation. For this purpose, IDS needs a common definition for standardised technical implementation. We argue that before policies and programmes such as IDS are promulgated and advocated for globally, there should be a strong economic and effectiveness case underpinning it; otherwise, it may be an intervention ill-suited for various settings but especially for low- or middle-income countries. Ultimately, future evaluations should be conducted using an agreed IDS definition, robust study designs, and a common evaluation framework for improved comparability across studies.

Author statements

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Ethical approval

Not required for scoping reviews.

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Competing interests

AL is the editor-in-chief of the journal. All other authors declare there is no conflict of interest.

Role of funders

The funder had no role in the development of the protocol and review.

Contributions of authors

- Search strategy development and conducting the Medline and Embase searches: CDB
- Screening and study selection: CDB, GMF, and GB (main search), GMF and GB (Epistemonikos search), GMF and NHA (additional Medline and Embase search), SB and GMF (grey literature)
- Data extraction: GMF, JB, JR, and NHA (main search), GMF and SB (Epistemonikos search), GMF and NHA (additional search), additional data extraction on funding and COI (GMF)
- Production of matrix of studies included in reviews: NHA, and JR
- Development of quality assessment criteria for reviews: GMF
- Development of criteria for overall quality assessment (reviews): JB, and GMF
- Quality assessment: GMF, JB, JR, NHA (reviews); GMF, SB, and NHA (primary studies)
- Production of narrative summaries: AL (reviews), GMF (RQ-3, and quality of included primary studies), JB (RQ-1), JR (RQ-2), SB (primary studies)
- Production of tables and figures: AL (characteristics of reviews), GF (PRISMA flow chart, characteristics of primary studies, funding and COI, quality assessment tables, list of abbreviations, glossary, table of excluded studies)
- Arbitration: AL
- Responsible for draughting of the review: GMF (GMF, AL, JB, and SB contributed to the discussion)
- Workstream lead: GMF
- All authors read and approved the final version

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.02.018.

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