Review

Public Health Informatics Practice in Governmental Health Departments in the United States: Scoping Review

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Abstract

Background: Public health informatics has been defined as "the systematic application of information and computer science and technology to public health practice, research, and learning" and is particularly critical to the design and implementation of systems and networks that support the activities of public health jurisdictions. Many literature or scoping reviews have focused on specific concepts within informatics but have left a gap in understanding the overall trends in published literature across the breadth of public health informatics practice. A broader assessment may better reflect the full scope of current practice and more comprehensively characterize the evolution of this field.

Objective: This review was aimed at characterizing the current practice of public health informatics within the United States, specifically within governmental health departments.

Methods: The PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines and recommendations were followed. Three databases were searched for various public health informatics terms: PubMed, the National Library of Medicine's biomedical literature database, which includes MEDLINE and other resources; ProQuest Public Health Database; and CINAHL. Two reviewers assessed the articles using a 2-tiered process first to determine eligibility based on the inclusion criteria and the second to identify the informatics implementation and jurisdiction.

Results: A total of 4581 publications were identified, of which 141 duplicate articles across the 3 data sources and 25 articles published prior to 2010 were removed. Based on initial screening of titles and metadata, 3249 articles were removed. The remaining 1166 articles underwent abstract and full-text review, resulting in 229 articles that met all eligibility criteria. Among the themes represented, 30.80% of articles involved surveillance systems or disease registries and 24.05% addressed aspects of health information exchange (HIE), including connecting to HIE entities, performing direct exchange between clinical systems, or developing system interoperability. State health departments accounted for 32.07% of the published articles, followed by federal or tribal implementations (30.38%). Implementations at local health departments were the least frequent (16.03%).

Conclusions: A growing body of published literature and gray materials focuses on public health informatics. This scoping review buttresses other published scoping reviews by providing a cross-sectional view of applied public health informatics across public health authorities in the United States. This cross-sectional view offers a foundation for further characterizing informatics practice within these authorities. The broad distribution of publications across different public health jurisdictions provides support for the idea that most authorities are involved in informatics practice in one way or another.

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Keywords: public health informatics; local health department; state health department; governmental health department; informatics practice

Introduction

Public health informatics is defined as "the systematic application of information and computer science and technology to public health practice, research, and learning" and is particularly critical to the design and implementation of systems and networks that support the activities of public health jurisdictions [1]. In the published literature, "public health informatics" first appeared as a term in 1995 [2]. In 2015, the Public Health Informatics Institute characterized the term's use in modern research and found that use rapidly increased in 2001, peaked in 2002, and then steadily declined [3]. This was accompanied by the creation of the MeSH term "public health informatics" in 2003 [4]. A scoping review of this new MeSH term was performed in 2017, which found a similar but slightly offset trend: a rapid increase from 2002 and a peak in 2004, followed by a steady decline [5].

Since that time, many literature or scoping reviews have focused on specific informatics concepts or their applications within disease domains or practice areas, such as disaster response, for example, by reviewing specific data management techniques and their applications in creating dashboards or how machine learning applies within the mental health sphere [6,7]. This differentiation and specification makes sense in the context of a growing and expanding field that encompasses the application of technology to public health practice. However, it has left a gap in the understanding of overall trends in published literature across the breadth of public health informatics practice. Bridging this gap might better reflect the full scope of current practice and more completely characterize the evolution of this field.

This scoping review aims to define and describe the evolution of public health informatics practice within the United States and categorize this evolution at various levels of governmental public health administration, including federal, tribal, territorial, state, and local jurisdictions. The results of this review will potentially be relevant to a variety of audiences, including public health decision-makers, such as state and local health department leadership; policymakers, such as those at the Centers for Disease Control and Prevention (CDC); and others involved in public health work impacted by informatics implementation.

Methods

Design

To identify publications for inclusion in this scoping review, the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines and recommendations were followed (Checklist 1) [8,9]. The objective of this scoping review was to characterize the current practice of public health informatics within the United States, specifically within governmental health departments. Searches were completed on July 6, 2025.

Search Strategy

Searches were completed within 3 databases: PubMed, the National Library of Medicine's biomedical literature database, which includes MEDLINE and other resources; ProQuest Public Health Database; and CINAHL [10-12]. PubMed, CINAHL, and ProQuest were selected because, together, they provide broad and relevant coverage of the public health literature most aligned with the scope of this review without overemphasizing biomedical or clinical research. Each database was searched for an intersection of terms that included "public health informatics," along with recommended vocabulary extensions of these terms. Medical or clinical applications were specifically excluded. The selection of search terms was based on the historical use of the term and its acceptance as part of the public health vocabulary [3,5]. Additionally, searches were limited to the United States. Using a subset of search terms after initial searches without geographic restrictions yielded more than 10,000 results. The complete search terms are outlined in Multimedia Appendix 1. Search results were further constrained to publications in English. The searches were limited to 2010 onward to allow sufficient time to characterize the evolution of the evidence, enable sufficient and robust characterization of practice, and align with national public health informatics assessments conducted by professional societies in the United States, specifically the National Association of County and City Health Officials, which began assessing topics more consistently in 2010 [13]. The ProQuest search was further refined to include terms within the subject indexing, abstract, and summary fields. Publication types were constrained to annual report, article, book, case study, conference, conference paper, conference proceeding, country report, dissertation/thesis, essay, evidence-based health care, feature, front page/cover story, fund/grant/fellowship/award, general information, government and official document, industry report, instructional material/guideline, interview, literature review, report, review, statistics/data report, technical report, undefined, website/webcast, and working paper/preprint; these categories were considered to identify the most relevant literature source types.

Study Selection

Search result bibliographies were imported into the Rayyan online systematic review platform, and duplicates were identified and removed [14]. Initial screening of title and metadata was conducted to identify articles describing public health informatics applications across governmental public health agencies in the United States. Subsequently, 2 independent reviewers conducted full-text reviews and classified the studies according to population, governmental level, and informatics application using the Rayyan platform and Excel (Microsoft 365). Agreement between the 2 reviewers was 85.22%, with κ=0.414 (SE 0.034). Most disagreements (138/161 articles) centered on the level at which the informatics intervention was implemented. Disagreements regarding eligibility and classification were

discussed by the reviewers, and they then reached a final adjudication for each instance.

Eligibility Criteria

Eligibility criteria are presented in Textbox 1.

Textbox 1. Eligibility criteria for articles in the present scoping review.

Inclusion criteria

- The article describes the application of an informatics project in a real-world setting (ie, not a theoretical discussion). Pilot and feasibility studies are included.
- The implementation site is a governmental public health department in the United States. Studies involving multiple implementation sites or sites at different jurisdictional levels, as well as those performed in partnership with nongovernmental organizations, are included.

Exclusion criteria

- The informatics intervention exclusively targets individual medical or clinical outcomes (eg, clinical trials or medical device use).
- The article describes only public health informatics workforce competencies, capacities, or academic strategies.
- The article does not have any full-text version (eg, conference proceedings, abstract-only submissions, or notifications of upcoming research).
- The article is a review of published literature (eg, a literature review).
- The article is not an empirical study (eg, an editorial or opinion piece).

Data Extraction and Synthesis

Information from each included article was extracted to identify the (1) implementation site and (2) informatics intervention. Informatics interventions were categorized based on the stated purpose of each study and grouped into themes. A study could be categorized into multiple themes, where applicable. Themes were identified in an iterative way based on initial keyword codes generated during the abstract and full-text reviews and then grouped into likely themes. These themes were reviewed, combined where appropriate, and finalized into broadly meaningful categories, as described in Textbox 2 [15]. The initial keyword codes and grouped themes were normalized against informatics activities assessed by professional societies and informatics professional competencies. However, given the evolving nature of public health informatics, as discussed previously, themes broadly associated with informatics competencies (eg, large dataset management or data processing automation) but falling within more specific domains, such as genomic epidemiology, were retained [13,16-18]. Themes were determined for the final included articles and articles excluded at the final assessment step, which focused on whether the implementation site was a federal, state, or local governmental health department. This step was aimed at identifying areas of informatics research and development undertaken by nongovernmental organizations that could benefit governmental health departments. Descriptive statistics were calculated; no statistical tests were performed to assess these categorizations or distributions. This study was reviewed by the Institutional Review Board of East Tennessee State University.

Textbox 2. Thematic categorization of articles included in the scoping review.

The following themes were identified:

- Dashboards and data availability
- Data standardization
- Data warehousing, including data linkage, big data, and data mining
- Disease forecasting and modeling
- Electronic case reporting
- Electronic health record use for purposes other than direct patient care, including integration of alerts, disease surveillance, and identification of unknown patients
- Electronic laboratory reporting
- Health information exchange or data exchange, system integration, and interoperability
- Means to access health information
- Means to disseminate health information
- Immunization information systems
- Informatics of genomics
- Infrastructure
- Use of online communities for public health interventions
- Social media and search engine–based disease surveillance
- Social media content and sentiment analysis
- Software or app development, including symptom monitoring platforms

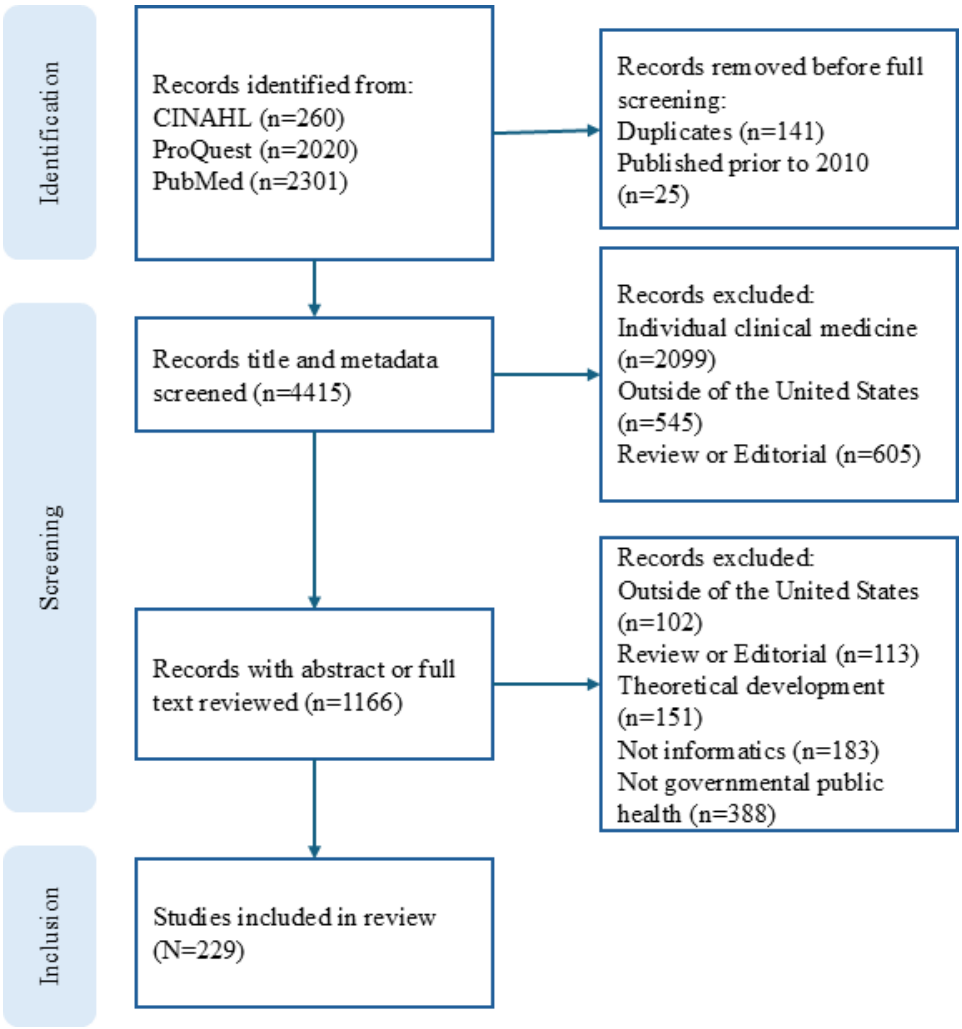
- Surveillance systems, including disease registries
- Syndromic surveillance
- Technology and communication tool use, including mobile app use, exposure and location tracking, and use of social media or search engines

Results

Study Selection

The search yielded 4581 results, of which 286 potential duplicates were detected and reviewed, resulting in the removal of 141 duplicate articles across the 3 data sources. Additionally, 25 articles published prior to 2010 were excluded (Figure 1). Based on initial screening of titles and metadata, 3249 articles were removed. The remaining 1166 articles underwent abstract and full-text review, resulting in 229 articles that met all eligibility criteria.

Figure 1. Scoping review search and screening outcomes.



Study Characteristics

The 229 included articles were published between 2010 and 2025, with 80.79% published during the last 10 years. Because the search was performed in July 2025, the count for 2025 was incomplete (Table 1). Six articles (2.62%) were published in the gray literature. Among the themes represented, 31.88% of articles involved surveillance systems or disease registries, and 24.89% addressed aspects of health information exchange (HIE), including connecting to HIE entities, performing direct exchange between clinical systems, or developing system interoperability (Table 2). Articles were categorized by their implementation jurisdiction. When multiple local health jurisdictions were involved, the article was categorized as local. When different levels of jurisdictions were included (eg, state and local jurisdictions), the article was categorized as involving multiple jurisdictions. Only 1 article included a tribal jurisdiction; because the implementation involved other local public health jurisdictions, the article was categorized as having multiple jurisdictions. State health department implementations accounted for 33.19% of the articles, followed by federal implementations (31.44%), as outlined in Table 3. Implementations across local health departments were the least frequent (16.59%).

Table 1. Count of included articles by year.

Year	Article count (n=229)
2010	6
2011	14
2012	10
2013	5
2014	9
2015	11
2016	15
2017	15
2018	15
2019	10
2020	18
2021	31
2022	26
2023	22
2024	16
2025	6

Table 2. Count and percentage of articles across themes[a].

Theme	Count (n=229)	Percent (%)
Dashboards and data availability	24	10.48
Data standardization	8	3.49
Data warehousing, including data linkage, big data, data mining	22	9.61
Disease forecasting and modeling	4	1.75
Electronic case reporting	4	1.75
Electronic health record usage for purposes other than direct patient care, including integration of alerts, disease surveillance, identification of unknown patients	27	11.79
Electronic laboratory reporting	10	4.37
Health information exchange or data exchange, system integration, and interoperability	57	24.89
Immunization information systems	9	3.93
Informatics of genomics	0	0.00
Infrastructure	2	0.87
Means to access health information	7	3.06
Means to disseminate health information	4	1.75
Use of online communities for public health interventions	0	0.00
Social media and search engine-based disease surveillance	2	0.87
Social media content and sentiment analysis	1	0.44
Software or app development, including symptom monitoring platforms	10	4.37
Surveillance systems, including disease registries	73	31.88
Syndromic surveillance	31	13.54
Technology and communication tool use, including mobile app use, exposure and location tracking, use of social media or search engines	21	9.17

[a]Articles could be assigned to more than 1 theme

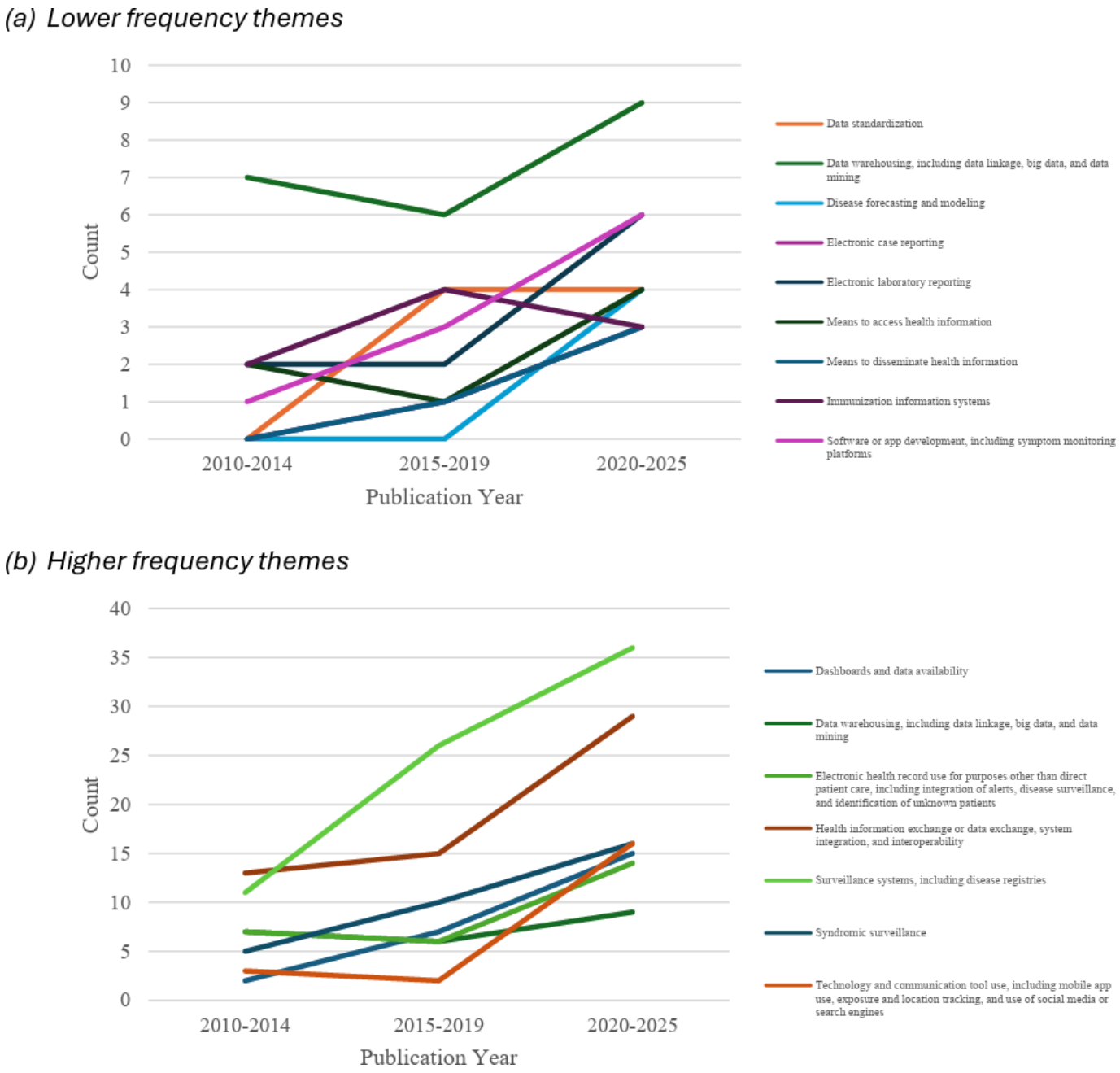
Table 3. Distribution of articles by implementation jurisdictions.

Jurisdiction	Count (n=229)	Percent (%)
Federal	72	31.44
State	76	33.19
Local	38	16.59
Multiple jurisdiction types	43	18.78

Themes Over Time

When reviewed in 5-year periods, the literature demonstrated an overall increase in publication frequency across most themes, with a few inconsistencies among less frequently represented topics, such as social media (Table 2). The most frequently represented themes over time were surveillance systems and HIE, with consistently increasing numbers for articles on syndromic surveillance and dashboards (Figure 2). Themes represented consistently but less frequently included data warehousing, electronic case reporting, and electronic laboratory reporting (ELR).

Figure 2. Frequency of publications in selected themes by 5-year periods, 2010-2025. (A) Lower frequency themes. (B) Higher frequency themes.



Themes by Implementation Site

Among the most frequently published themes, research on surveillance systems was published most often by states (43.84%). Research on HIEs, electronic health records (EHRs), and dashboards was published relatively commonly by all jurisdiction types. Research on syndromic surveillance was most published by federal (41.94%) or multiple jurisdictional levels (29.03%). Research on technology and communication tool use was infrequently published by local jurisdictions (4.76%) (Table 4). Overall, federal and state jurisdictions most frequently published research on surveillance systems and disease registries (n=18 and n=32, respectively) with local jurisdictions publishing on HIE most frequently (n=16).

Table 4. Distribution[a] of articles by theme and implementation jurisdiction.

Themes	Articles, n (%)			
	Federal	State	Local	Multiple
Dashboards and data availability (n=24)	25.00 (6)	45.83 (11)	16.67 (4)	12.50 (3)
Data standardization (n=8)	37.50 (3)	12.50 (1)	12.50 (1)	37.50 (3)
Data warehousing (n=22)	27.27 (6)	31.82 (7)	9.09 (2)	31.82 (7)
Disease forecasting and modeling[b] (n=4)	25.00 (1)	0 (0)	50.00 (2)	25.00 (1)
Electronic case reporting[b] (n=4)	0 (0)	50.00 (2)	25.00 (1)	25.00 (1)
Electronic health record use (n=27)	25.93 (7)	29.63 (8)	25.93 (7)	18.52 (5)
Electronic laboratory reporting (n=10)	10.00 (1)	50.00 (5)	40.00 (4)	0 (0)
Health information exchange (n=57)	17.54 (10)	38.60 (22)	28.07 (16)	15.79 (9)
Immunization information systems (n=9)	0 (0)	55.56 (5)	11.11 (1)	33.33 (3)
Infrastructure[b] (n=2)	50.00 (1)	0 (0)	50.00 (1)	0 (0)
Means to access health information (n=7)	42.86 (3)	28.57 (2)	14.29 (1)	14.29 (1)
Means to disseminate health information (n=4)	50.00 (2)	50.00 (2)	0 (0)	0 (0)
Social media and search engine–based disease surveillance[b] (n=2)	0 (0)	0 (0)	100.00 (2)	0 (0)
Social media content and sentiment analysis[b] (n=1)	100.00 (1)	0 (0)	0 (0)	0 (0)
Software or app development (n=10)	20.00 (2)	10.00 (1)	40.00 (4)	30.00 (3)
Surveillance systems, including disease registries (n=73)	24.66 (18)	43.84 (32)	12.33 (9)	19.18 (14)
Syndromic surveillance (n=31)	41.94 (13)	16.13 (5)	12.90 (4)	29.03 (9)
Technology and communication tool use (n=21)	33.33 (7)	42.86 (9)	4.76 (1)	19.05 (4)

[a]Percentages were calculated by dividing the article count within each implementation jurisdiction and theme by the total article count for that theme.
[b]Percentages based on less than 5 articles.

Implementations Within Nongovernmental Sites

In total, there were 388 articles that were on public health informatics topics with implementations that did not take place at governmental public health agencies or institutions and were therefore excluded from initial review, as shown in Figure 1. These articles were not included in the results presented above. However, these articles received the same level of thematic review and discussion as previously described for the scoping review dataset. The findings highlight domains of public health informatics research that may benefit governmental public health agencies. Overall, nongovernmental teams published more frequently than governmental agencies on data warehousing, disease forecasting, using EHRs for non–single patient research or surveillance, using social media or other similar sources for disease surveillance, using social media and crowdsourcing sites to understand how people feel about health topics or issues, and developing and deploying software and apps for health tracking, as well as on how people access health information and how groups disseminate it (Table 5). Most notably, only nongovernmental organizations published articles on genomics informatics and the use of online communities for health improvement; no governmental agencies published articles on these topics.

Table 5. Distribution of informatics themes across governmental and nongovernmental implementations.[a]

Theme	Governmental	Nongovernmental
Dashboards and data availability	24	12
Data standardization	8	8
Data warehousing, data linkage, big data, data mining	22	53
Disease forecasting and modeling	4	21
Electronic case reporting	4	0
Electronic health record use for non–direct patient care purposes, including integrating alerts, disease surveillance, and identifying unknown patients	27	57
Electronic laboratory reporting	10	1
Health information exchange or data exchange, system integration, and interoperability	57	22
Immunization information systems	9	1
Informatics of genomics	0	5
Infrastructure	2	1
Means to access health information	7	32
Means to disseminate health information	4	14

Theme	Governmental	Nongovernmental
Use of online communities for public health interventions	0	12
Social media and search engine–based surveillance	2	27
Social media content and sentiment analysis	1	44
Software or app development, including symptom monitoring platforms	10	20
Surveillance systems, including disease registries	73	6
Syndromic surveillance	31	18
Technology and communication tool use, including mobile app use, exposure and location tracking, and use of social media or search engines	21	88

[a]Articles could be assigned to more than 1 theme.

Discussion

Principal Findings

A growing body of published literature and gray materials focuses on public health informatics. This scoping review complements published scoping reviews by providing a cross-sectional view of applied public health informatics across public health authorities in the United States [3,5,7]. This cross-sectional view can serve as a foundation for further characterizing informatics practice across these authorities. The broad distribution of publications across different public health jurisdictions supports the idea that most authorities are involved in informatics activities, as identified in assessments by professional societies [16,17]. However, these assessments also indicate a likely gap in the published literature across various topics and jurisdictions. For instance, only 3.8% of the articles considered in this review involved immunization information systems (IISs), although every state and many territories or other jurisdictions operate IISs [19]. Therefore, the count and frequency of publications should not be used as a direct reflection of informatics activity or capacity within governmental public health agencies. Rather, they should be examined as complementary data to better understand the breadth and scope of these activities and capacity. This warrants further exploration of barriers to and facilitators of publication by these agencies to ensure that the published literature more comprehensively reflects practice. Researchers and policymakers who rely exclusively on published literature will have only a partial understanding of current informatics practice. Without accounting for other common avenues for knowledge transfer in public health informatics, such as conference presentations, webinars, and communities of practices, the full scope of public health informatics practice in the United States cannot be fully characterized.

Surveillance systems and HIE were approximately 2-3 times more frequently reported in the published literature than the next most frequently represented themes. One potential explanation for the higher publication frequency of surveillance systems is that both the CDC's Epidemic Intelligence Service and the Council of State and Territorial Epidemiologists' Applied Epidemiology Fellowship programs require surveillance system evaluation as part of their competencies or deliverables [20,21]. In numerous articles on HIE, additional data systems, such as true HIE systems, standalone EHR systems, health billing systems, and health service provider systems, were queried to supplement disease investigations, case ascertainment, or linkage to care or care cascade activities. These activities are among the essential services of public health agencies, as defined by the CDC, and their core role may explain their frequent publication [1,22]. Additionally, foundational topics, like public health informatics infrastructure, were not well represented in this scoping review. This is likely because these topics are not well suited to the format of most scientific literature (background, methods, results, and conclusions). To document more formally such foundational work, journals can consider publishing special issues that allow alternative formats or meta-publications of symposia and conference summaries, such as those previously published by the American Medical Informatics Association [23-25].

The increase in publications on public health informatics topics over the study period is attributable to multiple factors. The 2009 Health Information Technology for Economic and Clinical Health Act offered considerable investment in health care technology, data exchange, and specific public health programs, such as ELR and syndromic surveillance [26]. Additionally, advocacy and educational efforts by several national partners toward Congress led to initial data modernization–related funding for public health authorities in 2019 [27,28]. This funding was expanded, partly in response to the COVID-19 pandemic and the gaps in public health surveillance and monitoring infrastructure highlighted during this unprecedented emergency [29-32]. These national efforts to increase technical and financial support for data infrastructure and specific exchange activities resulted in corresponding increases in activities and staffing at public health authorities. While none of these funding activities specifically required peer-reviewed publication, the overall increased support likely provided both the material and opportunity for publication.

There remains much to be learned from public health informatics practices outside public health authorities. A review of the literature published by these institutions, groups, and collaboratives highlights overlapping themes of interest between public health authorities and nongovernmental groups. Research and development efforts by nongovernmental groups may be made more robust by involving public health authorities, which may be ultimately tasked with implementing projects, tools, or findings throughout the

project, from conception to publication. It is also unclear to what extent public health authorities are aware of research conducted by nongovernmental groups that may benefit them. The robustness of informatics research partnerships across sectors, as well as the translation of public health informatics activities from academic research and development to practical implementation, warrants further investigation. Some themes are more frequently published by nongovernmental organizations; however, understanding the motivations of these researchers for pursuing specific topics was beyond the scope of this study. Additional characterization is warranted in future work. Regardless, the overlap in themes between governmental and nongovernmental agencies may provide opportunities for collaboration and partnership. The findings of this scoping review may encourage public health authorities to explore some of these topics for their further development.

Limitations

This scoping review included only published literature. Efforts were made to include resources featuring gray literature, such as dissertations, magazines, newsletters, and conference abstracts not fully represented in proceedings. Regardless, relevant projects may not have been represented within the original dataset considered for this review. The use of "public health informatics" and its extensions as search terms may also have limited the included articles to those tagged by their authors as being related to informatics or those having terms commonly associated with informatics. If this link was not reflected in the indexing of the materials, articles containing informatics content may have been missing in the search results. Additionally, public health informatics is heavily influenced by technological and software developments, both of which continue to evolve rapidly. Consequently, defining which projects fall within and beyond public health informatics practice is not always straightforward and may involve subjectivity based on public health experience. The presented results should be interpreted within this context.

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Generative AI Use

The authors attest that there was no use of generative artificial intelligence (AI) technology in the generation of text, figures, or other information content in this manuscript.

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Data Availability

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Authors' Contributions

KG created and executed the research protocol, provided review for all included articles , and wrote the manuscript. JM provided review for all included articles. WA, MS, and MQ provided direction to scope the research protocol, reviewed and refined initial analysis, and editorial review of the manuscript. All authors reviewed the final manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Search terms.
[DOCX File (Microsoft Word File), 15 KB-Multimedia Appendix 1]

Checklist 1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist.
[PDF File (Adobe File), 509 KB-Checklist 1]

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Abbreviations

CDC: Centers for Disease Control and Prevention
EHR: electronic health record
ELR: electronic laboratory reporting
HIE: health information exchange
IIS: immunization information system
NACCHO: National Association of County and City Health Officials
PRISMA-ScR: Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews

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