Perceptions and Usage of "Public Health Informatics"

A keyword-in-context analysis

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Introduction

As an emerging discipline, the word "informatics" is unfamiliar to most people. Few dictionaries have included the term, and the definitions provided are limited despite attempts to reach agreement on a number of elements, including usage, definition and the terminology distinct to this emerging discipline. Merriam-Webster's online dictionary defines it as "information science."[i] The Oxford English Dictionary cites the British and World English dictionary, with the definition listed as "computing-the science of processing data for storage and retrieval, information science."[ii] The thesaurus provided by the website "The Free Online Dictionary" offers the most extensive description:

The science concerned with gathering, manipulating, storing, retrieving and classifying recorded information; a particular branch of scientific knowledge; "the science of genetics"; a branch of engineering science that studies (with the aid of computers) computable processes and structures; human language technology, natural language processing, NLP, and an branch of information sciences that deals with natural language information.[iii]

This lack of an established, shared definition contributes to challenges for those seeking to strengthen the science of informatics within the domain of public health. As an emerging field, the term "informatics" is also not familiar to many professionals in the field of public health, despite the fact that informatics is in one way or another—often unbeknownst to them—an integral part of their job. This engagement in informatics activities (even when they are not labeled as such) occurs because public health, like many other fields, is heavily reliant on timely, accurate and meaningful information.

The Centers for Disease Control and Prevention (CDC) has engaged the Public Health Informatics Institute (PHII) to assist them in developing communication strategies that clearly define the term public health informatics, with an end goal of developing workforce capability and driving demand for informatics training programs. As part of that work, PHII has compiled examples of the use of the term informatics through a content analysis activity to gauge current use of the term and how this usage is likely to shape resulting public understanding. This analysis is intended to assist with and inform communications efforts that may be needed to overcome common misconceptions.

Etymology of the word "Informatics"
According to the Oxford English Dictionary, the term informatics can be traced back to its first usage in 1957, when it was coined as an amalgamation of "information" and "automatic" to describe automatically processing information. The linguistic formula used to combine these two root words follows the accepted practice for naming some scientific fields—e.g., economics, optics mathematics, etc.

The conflation of public health informatics with health IT

In public health, the distinction between informatics and information technology (IT) is often unclear. Within the human resources field, such a distinction is a critical aspect of how positions are created, categorized and assigned salaries. The Public Health Informatics Institute has put forward the following definition of public health informatics: "Public health informatics is the effective use of information and information technology to improve public health practice and outcomes."

The authors contend that informatics is a practice-based framework that is applied to an existing discipline—a key distinction between informatics and information technology. Informatics requires an interdisciplinary approach that is based on content and subject matter expertise. For any informatics-based field, informatics supplies the methods, but the core principles of the field must be drawn from the foundational discipline. For example, music informatics and public health informatics may employ parallel techniques, but the professionals working in these fields will require very different backgrounds and expertise.

A lack of widespread understanding of what the field of informatics entails can result in human resources recruitment processes that target candidates who lack needed skills. The conflation of information

technology and informatics—and by extension public health informatics and health IT—can mean that necessary core competencies are overlooked and unsuitable candidates are chosen. Additionally, this knowledge gap can result in public health practitioners being under-informed about or entirely unaware of informatics and how it can support their work. They also may be unable to recognize when they are engaging in work that could be classified as informatics, leaving them poorly equipped to complete this work or seek out evolving best practices. Without the benefit of tapping into the larger, ongoing body of work around informatics and engaging with a larger community of practice, these individual practitioners are left in isolation to essentially reinvent the wheel for their own work.

Because it still is an emerging discipline, a lack of agreement surrounds the professional definitions of "informatics." This analysis seeks to document existing usage of the term in order to understand how the field may be currently understood by both the general public and academia.

Methods

To contribute to the effort to communicate informatics more effectively to various public health audiences, an adapted keyword-in-context analysis (KWIC) was conducted.[iv] This technique is based on a review of text to understand a concept by identifying themes which emerge in common usage by aggregating and examining instances of the word as it appears in publications. The objective of the content analysis is to enable valid inferences from reviewed text, and to identify attitudes or themes that would inform communications strategies. The analysis is focused on three areas related to workforce development issues. These include:

- The use of the term "informatics" broadly.

  An online search of various terms such as transportation informatics[v], mental health informatics[vi], space lab informatics[vii], food safety informatics[viii] and climate change[ix] ecology informatics[x] identified research briefs, articles, blogs, books, websites and proposals. These disciplines are included as informatics activities and domain areas which may not have academic training programs, but could be also considered as emerging informatics practices.

  To assess the frequency with which informatics is applied to these disciplines, a search in Google Books was conducted to produce an estimated number of books published on each application of informatics.

- The use of the terms "public health informatics" and "medical informatics" in academia.

  "Medical informatics" was chosen for comparison to "public health informatics" because it is a more established discipline and could provide a yardstick with which to measure the growth of "public health informatics." An online review of articles published in peer-reviewed journals was conducted in the PubMed academic database. PubMed was chosen as a thorough and specialized database for medical publications, housing peer-reviewed scientific journals dating back to 1966. Of the articles obtained from the PubMed database, 138 from the last five years were chosen for analysis based on their timeliness and the availability of the full text. Using the qualitative analysis software tool Dedoose[xi], a keyword-based analysis was conducted to measure the frequency and co-occurrence of words related to three themes: workforce development, IT, and concepts related to the emergent and interdisciplinary nature of informatics.

- The use of the terms "public health informatics" and "medical informatics" in media.

  In order to gauge the contextual use of the key terms, a search was conducted to identify the common usages of the terms "public health informatics" and "medical informatics" in the media.

The search employed LexisNexis, chosen for its comprehensive cataloguing of newspapers, magazines, online news platforms and other media outlets.

Results

Broad usage

A wide range of search terms preceding the word "informatics" revealed that academic informatics programs include diverse offerings. These include domain areas such as music[xii]; policy[xiii], business[xiv], health (including nursing and bio-informatics)[xv], public health[xvi], architecture[xvii], nutrition science and informatics[xviii], and pharmacy informatics[xix].

A search of Google Books demonstrated that certain informatics disciplines have received more attention in publications than others. For instance, "medical informatics" yielded 143,000 results, while only 39 publications address "sports informatics" and 69 discussed "architecture informatics." The term "medical informatics" so exceeded the others in terms of usage frequency that it was left out of Figure 1 below so that it would not skew the graph's scale. Meanwhile, about 3,770 publications touch on "public health informatics," which is comparable with the prevalence of publications on the topics "business informatics" and "computer science informatics."

Figure 1: Number of publications across informatics disciplines
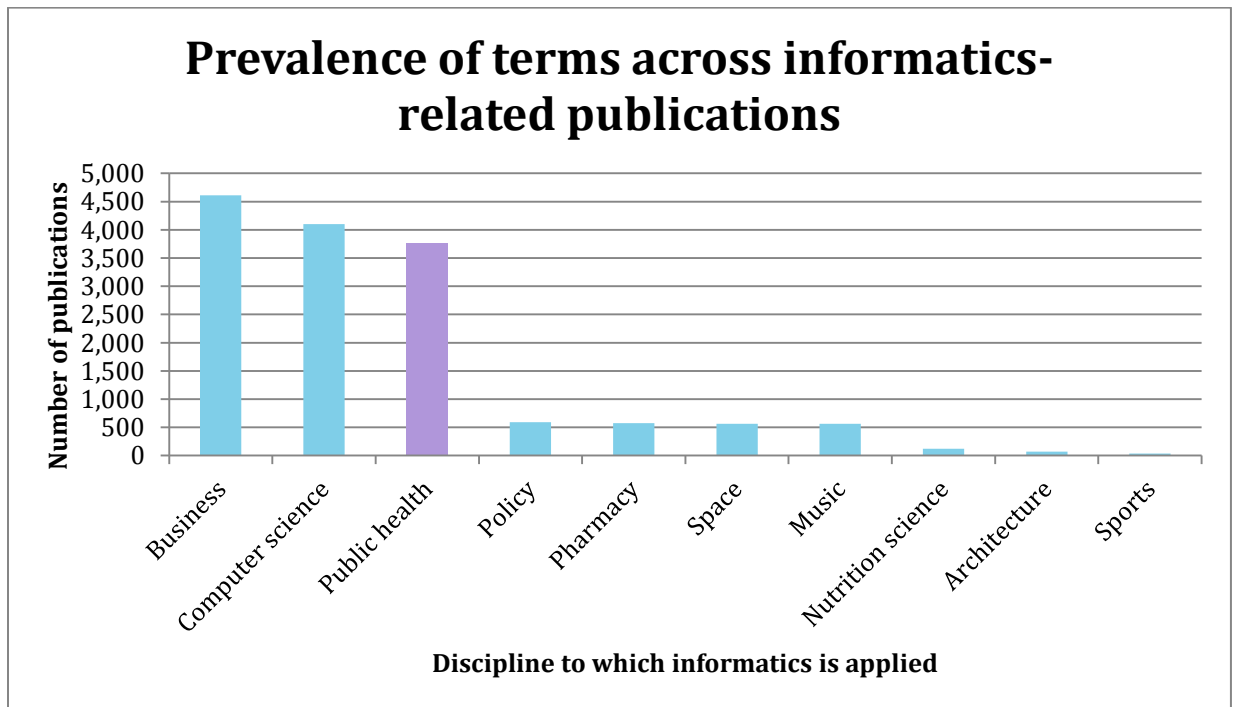

These broad applications of "informatics" highlight the broad applicability of the field, whether informatics is applied to leveraging the newest research on climate change or used to capture and analyze movements in dance. This insight is not surprising, since so many industries, including health care and public health, are highly dependent upon acquiring, analyzing and acting on timely and accurate information.
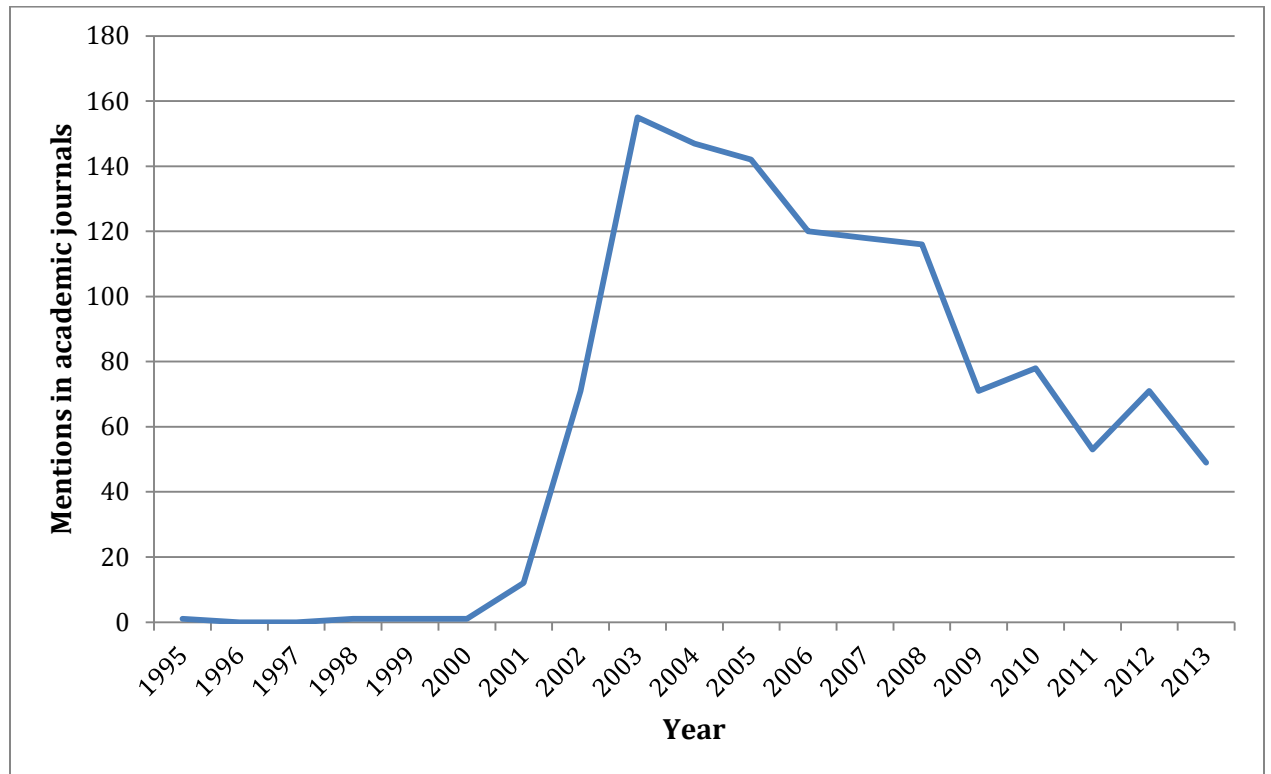
Usage in academia

Prevalence of term use

A review of published articles that incorporate the keywords "public health informatics" and "medical informatics" revealed them to be relatively new terms in academic writing. "Medical informatics" first began to emerge in the early 1960s (see Figure 2) and sharply increased beginning in the 1980s. By the 2000s, journals were publishing nearly 8,000 mentions of the term "medical informatics," as opposed to fewer than 500 in the 1980s. This increase is most likely attributable to growing interest in the field over the course of these decades.

Figure 2: Prevalence of "medical informatics" in academic publications by year
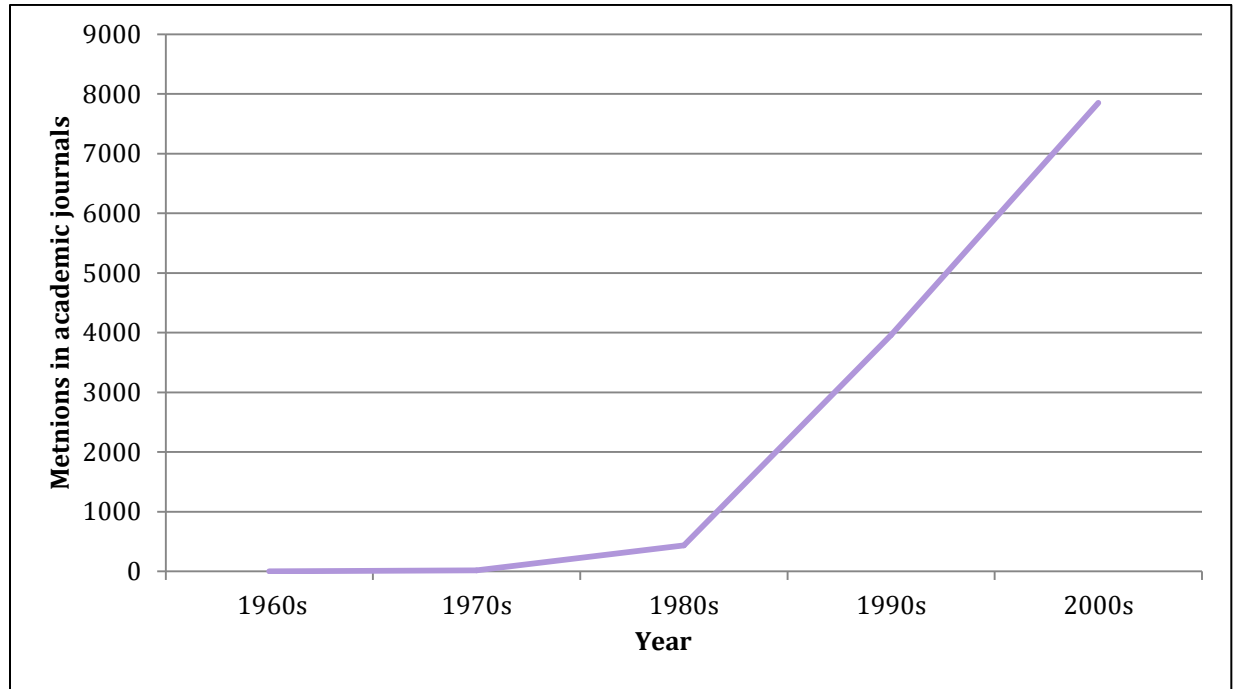
"Public health informatics" seems to have emerged in academic usage later. PubMed's first recorded mention of the term was in 1995, in an article titled "Public Health Informatics: How Information-Age Technology Can Strengthen Public Health."[xx] After this article introduced the concept of informatics as a field with possible crossover into public health, interest in the cross-section of these two disciplines picked up traction across other academic publications. Usage peaked in 2003 with 155 mentions.

Figure 3: Prevalence of "public health informatics" in academic publications by year
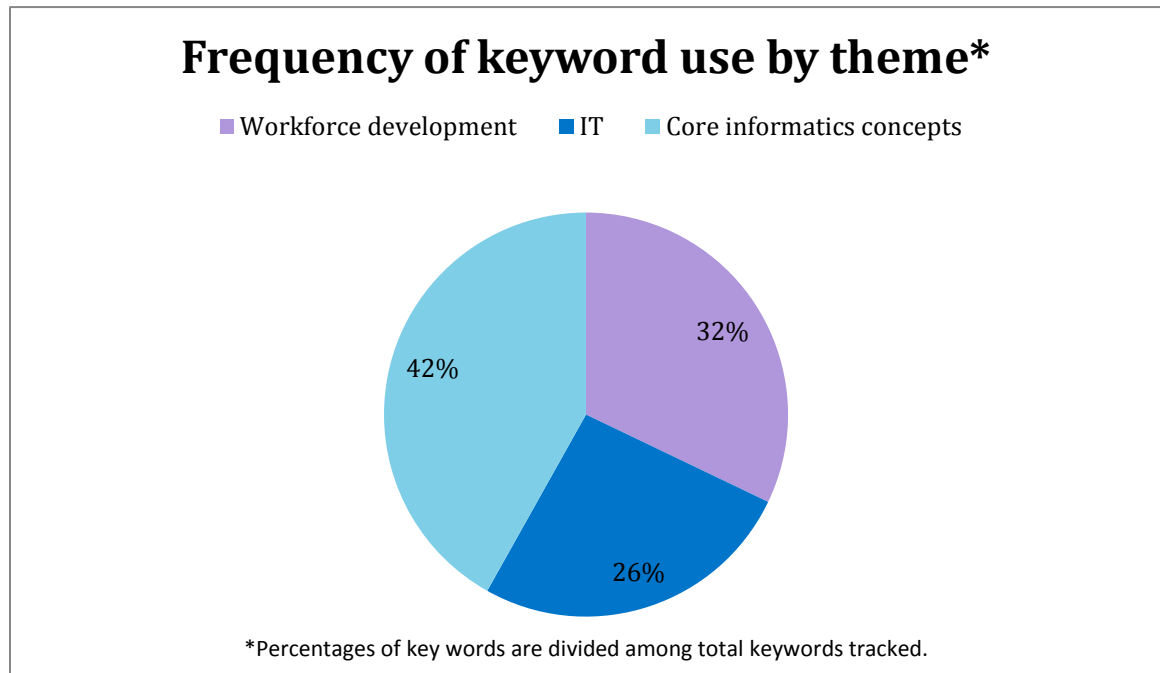

Text analysis of usage

An analysis of the frequency of key term usage in academic publications broke down keyword usage by three core themes:

- **Core informatics concepts** included the terms "interoperability," "emerging" and "discipline/interdisciplinary."
- **Workforce development** included the terms "skillset," "competency," "training" and "workforce."
- **IT** included the terms "health IT" and "information technology."

Figure 4: Frequency of keyword use by theme

Frequency of keyword use by theme*

■ Workforce development ■ IT ■ Core informatics concepts

32%

42%

26%

*Percentages of key words are divided among total keywords tracked.

The analysis demonstrated that the most frequently used terms were those related to core informatics concepts with 1,249 mentions, making up 42 percent of all keyword usage. Workforce development followed closely behind with 958 mentions and 32 percent of keyword mentions. IT-related terms had the fewest mentions at 776, which made up 26 percent of keyword usage. This analysis suggests that academic journals are most likely to discuss public health informatics in the context of its status as an emerging and interdisciplinary field. The needs of the emerging field of public health informatics to train a workforce and build professional competencies also seem to drive academic writing on the subject.

An analysis of co-occurrence of keywords, i.e., the frequency with which terms were used in combination with one another, somewhat contradicted the findings of the keyword-by-themes review. The co-occurrence showed a strong correlation between certain terms by tracking which terms were used in conjunction with one another. With 80 instances of co-occurrence, "informatics" and "information technology" showed the strongest correlative relationship, along with "public health" and "emerging." These relationships reinforce the findings of the keyword-by-themes review that public health informatics is likely to be discussed as an emerging and evolving field, and, unlike in academic publications, is highly correlated to mentions of IT. The weakest correlation present was between "discipline/interdisciplinary" and "health IT," with only 15 instances of co-occurrence. This weak correlation suggests that, where public health informatics is seen as an emergent field, it is least likely to be conflated with health IT. Both the shared findings and the inconsistencies between the keyword-by-themes review and the co-occurrence analysis raise questions about how individual usage of words may differ from correlated usages of term pairs.

Figure 5: Chart showing co-occurrence of keywords

	Discipline/ interdisciplinary	Emerging	Informatics	Interoperability	Public health	Public health informatics	Totals
Health IT	15	23	35	32	28	28	257
Information technology	32	57	80	55	77	66	519
Discipline/interdisciplinary		39	43	28	38	40	315
Emerging	39		77	43	80	63	496
Informatics	43	77		66			681
Interoperability	28	43	66		58	57	438
Public health	38	80		58			644
Public health informatics	40	63		57			596
Skill set/competency	20	27	26	24	21	26	240
Training	30	49	73	41	75	62	468
Workforce	20	25	32	21	32	31	250
Totals	315	496	681	438	644	596	

Key: Co-occurrence strength
70-80 mentions (strongest co-occurrence)
46-69 mentions
30-45 mentions
0-29 mentions (least strong co-occurrence)

Usage in news media

Prevalence of term use

"Public health informatics" is not a term that often arises in general media outlets. A search of LexisNexis yielded only 105 mentions from the last 10 years, of which 65 were news media outlets. Several of these results were duplicate articles from different news sources, further reducing the number of distinct stories addressing public health informatics to 60; this repetition is most likely due to newswire and stringer services like the Associated Press. "Medical informatics" is a more commonly referenced term, yielding 933 search results, 559 of which were news media outlets.

Text analysis of usage

Of the 60 media outlet mentions of the term "public health informatics," 41 of the articles only mentioned the term as part of the title of an institution, academic program or government office. These articles typically related news about an organization receiving a grant, winning an award or creating a new degree program. Of these 41 articles, only four provided any kind of background information, however brief, on the term "public health informatics."

The remaining 19 media mentions touched on a practical application of public health informatics; some of these articles summarized research or an informatics-based project; others used public health informatics concepts to provide insight on a larger news story or health trend, such as fluctuations in rates for risky health behavior in youth[xxi]. However, the majority of these articles mentioned public health informatics only in passing without illuminating how the discipline related to the subject of the article. Usually, the keyword was invoked only because the lead researcher's title or institution contained the term, even when public health informatics seems to be foundational to the work being described. For example, an article published in The Independent on health disparities leading to drastically lower life expectancies in the Northern U.K.[xxii] summarized a study led by public health informatics researchers, but only mentioned the discipline because it was part of the lead researcher's title.

Several of the articles, when they did offer an explanation of the field, conflated it with health IT. For instance, a 2006 article from Computerworld[xxiii] framed a data system initiative coming out of the CDC's

National Center for Public Health Informatics entirely as an IT-driven project without touching on the project's end goals around data use or touching on how informatics shaped the project.

Conclusions

Based on the media analysis of the term "public health informatics," the definitions of the field and the public discussions of its related terms still seem to vary widely. This lack of common ground for definitions and standards could prove to be an impediment to the field's progress, mainly as a barrier to the development and adoption of industry best practices. It also may reflect a lack of understanding that could cause hiring processes to misidentify needed competencies for informatics-related positions, resulting in underqualified candidates working in the field.

While academic writing invokes concepts central to public health informatics—e.g., interoperability and interdisciplinary approaches—it also thematically links public health informatics with the IT field, as do the news media. Though informatics can be a valuable tool in laying the groundwork for effective IT, that use is just one of a multitude of prospective uses. Defining public health informatics as only IT severely limits the scope of the discipline's capabilities.

This lack of a common definition calls for effective communication strategies that can play a crucial role in shaping the understanding of the informatics field as public health informatics continues to grow and evolve. By emphasizing and elucidating the capabilities of informatics to span disciplines, communication efforts may reduce the confusion surrounding the term. These strategies must emphasize that the expertise to properly apply informatics rests with the discipline the informatics is applied to, and delineate how the goals of informatics relate to but also differ from those of other disciplines, such as IT. This information could inform human resources processes in identifying and recruiting appropriate candidates for informatics positions. If the communications strategies are successful, they could also help organizations like public health departments realize the ways in which they're already implementing informatics, which could lead to improved public health practice and population health outcomes.

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