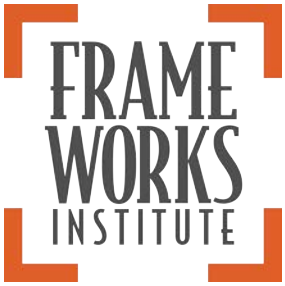

Making Public Health Informatics Visible:

Communicating an Emerging Field

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A FrameWorks Strategic Map the Gaps Report

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Introduction

Communicating about public health informatics and raising the profile of this emerging, interdisciplinary field of public health presents unique challenges. This report lays out these challenges and provides an initial set of strategies that communicators can use to address them. The research presented here was conducted in collaboration with the Public Health Informatics Institute, a program of the Task Force for Global Health, with support from the Centers for Disease Control and Prevention.

To identify communications challenges and initial recommendations, FrameWorks investigated the assumptions that "public health professionals"—people who work in the field of public health but who are not experts in informatics—use to think about ideas and concepts related to public health informatics. This approach is distinct from opinion research or content analysis in that it documents the thought processes and deeply held assumptions that not only inform what public health professionals say, but structure their thinking about new information.[1] Identifying *ways of thinking* is key to developing more effective and strategic communications. By understanding the ways that people reason about a topic, communicators can craft messages that avoid unproductive understandings, and activate ways of thinking through which people can better appreciate the role and importance of public health informatics in the larger field of public health.

This report is designed to answer four key questions:

1. What are the features of public health informatics that experts want to be able to communicate? The answers to this question comprise the **untranslated expert story of public health informatics.**

2. How do public health professionals think about public health informatics? The answers to this question comprise the **professional cultural models used to think about public health informatics.**

3. What are the primary challenges of communicating about public health informatics? The answers to this question comprise the **key communications challenges on public health informatics.**

4. What can communicators do to address these communications challenges and build better understanding of and support for public health informatics? The answers to this question comprise the **initial reframing recommendations.**

This research found that, at a general level, public health professionals are familiar with public health informatics. For example, they recognize that informatics lies at the nexus of technology and data management. There are, however, significant challenges that lie beneath this shared but highly superficial understanding. Even though they share a recognition of some of its basic characteristics, public health professionals do not think of public health informatics as a *field* that has a unique and important role alongside other fields of public health. As a result, the work of public health informatics remains largely

invisible. In addition, deep assumptions about the limits and challenges that face the field of public health generate skepticism among public health professionals about the types of innovations that informatics might offer. This skepticism, our analysis suggests, makes informatics seem nice in theory but unrealistic in practice and undermines support for the discipline and its contributions.

In the final section of this report, we offer strategies for overcoming these challenges. We detail how communicators can help public health professionals understand the unique contributions of public health informatics, how they can engender productive thinking about incorporating this work into public health research and practice, and how they can generate increased support for the investment of resources in public health informatics. These recommendations can be used by those seeking to more effectively engage public officials, organization leaders, and practitioners in understanding and valuing the science of public health informatics.

The Untranslated Expert Story

The following represents a distillation of the main themes that emerged from the analysis of expert interviews and a review of relevant materials about public health informatics. The points below represent the body of knowledge that subsequent communications strategies and recommendations seek to translate.

These themes can be categorized as responding to the following foundational questions:

1. Definition: What is public health informatics?
2. Goals: Why is public health informatics important?
3. Field: What distinguishes the field of public health informatics?
4. Challenges: What challenges does the field of public health informatics face?[2]

I. Definition: What is public health informatics?

Experts struggled to define "public health informatics" and acknowledged the difficulty of the task. In spite of this initial difficulty, there was a set of definitional themes that emerged from analysis:

- **Public health informatics is about *information*.** Overall, the core of public health informatics is "information." Public health informatics involves the collection, organization, manipulation, processing, communication, interpretation, and visualization of information—all in the service of public health and population health goals. The complexity of the field lies in what information is, what is meaningful and useful about information, and how it can be used to make decisions.

- **Public health informatics involves *creating and managing technologies.*** As many experts insisted, public health informatics is not *about* IT or computer science; rather, public health informatics *involves* technologies because the mandate to collect, package, process, and interpret information frequently requires some sort of technological tool(s). The plural "technologies" reflects the fact that public health informatics involves a multitude of technologies, from the use of "rocks in boxes" for determining infant mortality rates, to pencils and paper for recording data when electronic means are infeasible, to the most powerful and current IT solutions.

- **Public health informatics is about *data collection.*** Most experts asserted that the field of informatics participates in determining what kinds of data need to be collected, how much data should be collected, and how these data should be captured. Experts differed somewhat in how they talked about this stage of the information production process. Some experts discussed data collection mainly as the purview of the IT field (i.e., information technologists program data collection instruments), while others saw a stronger leadership role for public health informatics (i.e., informaticists design systems for data collection).

- **Public health informatics is about *data packaging.*** An important function of public health informatics is to collect data and manipulate it, code it, synthesize it, organize it, and essentially *package* it for use in a dynamic, bidirectional "information supply chain." This function is an important first step in transforming a mass of data into usable information.

- **Public health informatics is about *information flow.*** Once information is packaged, it needs to get to where it needs to go. Information flow was a very prominent theme in experts' talk, and was characterized spatially, with language like "flow" and "from point A to B." Public health informatics ensures that information is processed and sent to the appropriate people and/or organizations in the most efficient way possible. This process involves ensuring systemic integrity (e.g., maintaining confidentiality) and interoperability, developing standards, determining appropriate communication channels (e.g., email/fax/phone/software), and supporting coordination. Another important aspect of information flow is *evaluation.* Informaticists play a key role in providing feedback and offering improvements on the effective transfer of information.

- **Public health informatics is about *people.*** Repeatedly, experts emphasized that while public health informatics is about *systems,* it is even more crucially about *people,* at every stage of the information management process. Public health informatics not only accounts for the people whose data are aggregated (e.g., patients, members of a community), but perhaps more pertinently, the professionals who collect, process, analyze, share, and use the information. Public health informatics is invested in knowing how *all* of the professionals engaged in researching and implementing public health topics interact with technology and use information. Informaticists must know how all public health professionals (e.g., medical data coders, system interface designers, epidemiologists, clinicians, health commissioners, policymakers) orients to information in their daily professional practice and provide relevant, understandable, and useful information to these varied public health colleagues. In this way, informatics involves a strong *social science component.*

- **Public health informatics is *cross-cutting.*** Experts pointed out that while public health informatics is an important specialty in its own right, at its most effective it is a field that intersects with others. Informaticists see the "big picture" and "connects the dots" across all of the other fields related to public health. This interdisciplinary nature of the field is reflected in the training relevant to becoming an informaticist. Some experts characterized informatics as a cross-cutting field that provides crucial *support*, in that various public health fields rely upon informatics for information collection, management, etc., and to support decision-making.

II. Goals: Why is public health informatics important?

While public health informatics is a field in its own right, with its particular "inside baseball" jargon and professional conferences, the overall goals of the field are located squarely in supporting public health and addressing larger public health goals. Three general goals of the field emerged:

- **Public health informatics *is key to enabling effective monitoring and surveillance.*** Public health informatics makes the collection, packaging, and flow of massive amounts of data and information more reliable, efficient, and timely. This is crucial for the practice of surveillance, typically considered by many to be the purview of epidemiology.[3] While epidemiologists are generally responsible for analyzing data—e.g., interpreting statistics, identifying trends—informaticists are responsible for helping to guide data collection, "unpack the message," and share information in collaboration with epidemiologists and other public health professionals. Thus, public health informatics is important for making surveillance activities and programs more effective.

- **Public health informatics *supports improved decision-making.*** Experts explained that in order to make decisions, health professionals need support in the form of actionable, relevant, and timely information. Supporting decisions also requires providing information to diverse groups of health professionals working in diverse contexts. Public health informaticists determine how different types and scales of problems can be most appropriately addressed through the provision of relevant information. Supporting decisions also involves timeliness: providing appropriately packaged information quickly for more efficient and effective decision-making.

- **Public health informatics seeks to support the public health enterprise and *improve population health.*** The end goal of public health informatics is to promote effective health *interventions.* For many subfields of informatics, supporting interventions happens at the individual level; for example, an electronic health record interface that prompts a doctor to check for certain symptoms enables a better diagnosis and a more effective intervention. But informaticists also support interventions at the community and population level. For example, by supporting the production and sharing of timely, accurate, small-area statistics about asthma rates and associated infant mortality, informaticists can help communities better manage and improve interventions. Overall, good information leads to good decisions, which lead to better interventions and better health outcomes.

III. Field: What distinguishes the field of public health informatics?

The following closely related themes emerged as the distinguishing features of the field of public health informatics:

- **The public health informatics field *navigates the needs and goals* of diverse fields.** Experts asserted that not only do informaticists *know that* different organizations or different professionals have different practices, needs, and goals, but they understand *how* to navigate these differences and provide information that is relevant to these varied practices, needs, and goals. Public health informatics is crucial for making sure that health professionals have the right information for making appropriate decisions *based on the needs of a particular field.*

- **Public health informatics draws important *connections* across public health.** Much of the language that experts used to describe public health informatics focused on *connection.* Experts

talked about "bridging [the gap]" between subfields of public health and "connecting the dots" to reveal a "bigger picture." The practice of coding data is an important example. Coding data is the first step in packaging information, and public health informaticists know that the way that data are coded can change the meaning and use of information. For this reason, it is crucial to involve informaticists alongside IT specialists when designing a data collection system; the informaticist *bridges the gap* between the assumptions of the IT designer constructing the system, the epidemiologist analyzing the information, the health professionals using this information to decide on community-level interventions, etc.

- **Public health informatics' key function is *translation*.** At the most granular level, it is necessary to communicate—and to translate—in order to bridge gaps. If information is to flow efficiently to and from professionals working on all levels of public health, across local and global contexts, clear standards (e.g., of data collection, vocabulary, meaning, and use) need to be in place. Public health informatics is the subfield of public health that is able to work across the other subfields to create standards that work for everyone participating in—and using—the information supply chain. Public health informatics fills this important role because it functions as a translator across all parties.[4]

IV. Challenges: What challenges does the field of public health informatics face?

Experts described a range of factors that challenge the field to function effectively in the capacities described above:[5]

- **Public health informatics works *behind the scenes*.** Experts explained that informatics work—like most public health work—typically happens "behind the scenes" and that its results are often not tangible or visible in ways that those working in other areas of public health would recognize. To illustrate, one expert asked, "Where's our outbreak?" suggesting that unlike epidemiology, public health informatics does not have a clear and vivid distillation of its work that members of the public (or members of the field of public health) recognize.

- **Public health professionals do not fully recognize the *complexity of information,* and therefore, do not see the value of public health informatics.** Experts emphasized that effective public health informatics work requires substantial time and investment. Often, public health professionals in leadership roles want staff to simply "make it happen" and do not have the time or resources to consider the complexity of information and the importance of the systems development, testing, and training that informaticists do. The tendency for people outside a field to oversimplify a field's complexity is a common challenge in most disciplines, and is certainly relevant to public health informatics.

- ***Collecting data for data's sake* limits the usefulness of information.** Many experts had the impression that public health professionals across various fields have "data lust," and collect data for

the sake of having a lot of data. Experts described this practice as "let's collect it and then we'll figure it out," which results in "a big ol' bucket of stuff" that is not useful and ends up in a "data black hole." Experts warned that collecting large quantities of data without a guiding question, problem, or plan for its use is *destined for failure*, because integrating systems, packaging data, and disseminating useful information—the core functions of public health informatics—becomes nearly impossible. Though they did not cite specific examples of this problem, experts considered it an important concerns.

- **The workforce is uneven and *difficult to characterize.*** Experts suggested that public health informaticists can enter the field without a specific degree in the discipline, and because the field of public health informatics is cross-cutting, people from many different backgrounds are potentially suitable for public health informatics work. However, experts admitted that finding appropriately qualified professionals can be challenging, because few people have training in the set of necessary skills. Moreover, even when qualified individuals are hired, they are often "misused"—placed in IT departments, where the stereotype of the informaticist as IT support staff is reinforced, or located in epidemiology departments, where the important distinctions between these two fields are blurred.

Untranslated Expert Story of Public Health Informatics

What is public health informatics?

Relationship between data and technology:

- About information.
- Involves creating and managing technologies.

The information supply chain:

- About data collection (what, when, how).
- About data packaging.
- About information flow.

Relationship of users to information:

- About people.
- An interdisciplinary field.

Why is public health informatics important?

- Enables effective monitoring and surveillance, and other crucial public health functions.
- Supports improved decision-making and policy-making.
- Supports the public health enterprise and innovation to improve population health.

What distinguishes the field of public health informatics?

- Navigates the needs and goals of diverse fields.
- Draws important connections across public health, identifying interdisciplinary needs and solutions.
- Public health informatics' key function is translation.
- Public health informatics establishes interdisciplinary relationships.

The Professional Cultural Models Used to Think about Public Health Informatics

Below, we present the dominant professional cultural models—the shared assumptions and understandings[6]—that characterize how professionals working in a variety of public health fields think about public health informatics. Helping these professionals better understand public health informatics has the power to expand how it is valued and incorporated into the work of their organizations in order to improve health outcomes.

When we investigate "professional cultural models," we consider public health professionals to be members of a particular culture. Every profession is characterized by its own discourse—or ways of seeing, talking, and understanding—that are shared through communication and other practices within the culture. This discourse facilitates a common way of thinking that allows members of the profession to work productively together.[7] The 21 public health professionals interviewed for this research come from a range of backgrounds and occupy many different roles (e.g., public health organization leadership, direct client services, human resources, government relations, communications, administration, etc.). They also work across a diverse set of institutions (e.g., the federal government, state and local government, professional organizations, etc.). Despite these differences, these professionals share membership in the culture of public health, and a common commitment to realizing the goals of the field. Most importantly, our analysis finds that these professionals *do* have highly shared ways of thinking about their work, about their field, and about public health informatics.

In analyzing the talk of these participants, we highlight common patterns, rather than focusing on the differences that also exist among these members of the field. *Focusing on common understandings is the key to crafting communications strategies that acknowledge the deep conceptual features of a professional culture that both impede and facilitate thinking about new ideas and concepts.*

The professional cultural models presented below represent the patterns of reasoning that professionals rely on to make sense of public health informatics and related concepts. These patterns of thinking are not necessarily "correct," and experts might disagree with them, but they are important because they shape professionals' thinking and decision-making. Thus, public health informatics experts must be aware of and learn to navigate these existing patterns in order to more effectively communicate about their field and work.

I. Ideal vs. Real Modeling of Public Health

Deep assumptions about the difference between the *ideal* of public health practice and the *realities* of the field deeply structured participants' thinking about public health practice. This ideal/real distinction shapes thinking about public health informatics in ways that have important implications for

communicators. Participants offered a consistent vision of ideal public health practice, readily describing the details of how public health *should* work better and more efficiently to improve population health outcomes. This ideal vision is closely aligned with the goals of public health informatics experts. Despite the ability to think about an ideal, participant discussions consistently evidenced a deep understanding that this ideal vision is unattainable in the real world. This way of thinking pervaded general discussions of the field of public health, and has implications for more specific conversations about public health informatics.

The contrast between ideal and real thinking was threaded throughout participant discussions of public health. Below, we outline the dominant ways in which this pattern shaped participants' thinking.

A. Siloed Systems

Ideally, participants assumed, different organizations and departments within the field of public health should coordinate and communicate seamlessly. In reality, they explained, public health silos impede effective and efficient collaboration.

Participants' frequent use of the specific term "silo" signaled a deeply shared assumption about the field of public health: that it is composed of discrete subfields and institutions (e.g., agencies, departments, organizations) that operate in isolation from one another. This was sometimes attributed to organizational culture—unwillingness or inability to cooperate across organizational lines—and sometimes to systemic features such as separate, narrowly tailored funding streams that come with specific but disparate requirements.

> **Participant**: The other problem is we've had siloed funding. A portion of public health informatics gets built out, but it's for one disease. We've built surveillance systems because immunization had funding to do it. So, it's built for immunizations. It's not built to take care of a broader system or portfolio of issues. It's a big problem, a big challenge.[8]
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> **Participant**: Sometimes you have the data that's owned by the programs, and they own this data with ferocity, and they don't share the data, which is another problem. They won't share this data. And then they obviously won't make the data available.

Participants saw silos as an unfortunate reality, and they *ideally* thought that public health institutions should be better connected. Participants occasionally expressed this preference explicitly, but more often the ideal of connected public health practice was left implicit in their critiques of silos—in other words, by describing the important negative aspects of siloing, they implied that a more connected alternative would be ideal. This speaks to the pervasiveness and depth of the assumption that the reality of siloed systems is unchangeable, and highlights the dominance of the "real" perspective over the "ideal."

B. Scarcity

Participants consistently indicated that, ideally, public health would be consistently well funded to enable the field to build its internal capacity and develop new initiatives that would better allow it to meet challenges and achieve goals. Yet participants also deeply understood that, in reality, the field will continue to be hampered by insufficient and program-specific funding.

Shrinking budgets, insufficient staffing, and a lack of consistent funding were understood as an unfortunate but inevitable reality of the field of public health. This pervasive underlying sense of scarcity—the assumption that public health does not, and will never, have sufficient resources available—structured participants' thinking about working in public health and the ability of the field to achieve its goals. These ways of thinking were laced with strong senses of fatalism, as participants generally saw resource shortages as a simple and inevitable fact. In our interviews, this created a sense that nothing can be done, and in many cases, a feeling of resignation and defeatism over the prospect of improving the field in meaningful ways.

> **Participant**: It just goes back to funding and priority. And you only have a certain amount of funding, and you have [data] that you have to collect at a state level for federal funding, so you're going to have to have your epi's for that.
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> **Participant:** After 9/11 resources have started to dwindle. I mean, nothing bad has happened so people are trying to say "Oh, well we don't need to invest all of this money anymore because nothing bad is happening. And when something bad *does* happen we will throw it back in if we have to."

Ideally, public health departments and organizations would have ample funding to support programs and to build internal capacity to meet their goals. In reality, participants assumed, resources will continue to be scarce and internal capacity will continue to be insufficient.

C. Lack of Responsiveness

While participants assumed that, ideally, public health agencies should be agile and responsive, they very quickly and predictably returned to the opinion that this is not realistic. The assumed lack of responsiveness of the field, which is linked with assumptions about silos and scarcity, constrained participants' thinking about what public health is—and is not—capable of, and led to the kind of fatalistic thinking described above.

This assumption was particularly evident in how participants contrasted other fields—for example, medical informatics—with the field of public health. In these discussions, other fields were consistently seen as fast moving, nimble, and innovative, while public health was described as slow and less able to make changes to policies and practices.[9]

Participant: Doctors' offices have been doing [informatics] for years. We're just now getting to data that was collected and sorted and analyzed on computers and not on paper. So from a public health perspective I think public health informatics is still emerging compared to informatics in most other places, in other fields. […] If we had this conversation 20 years ago, we might be in a much different place than we are now. But I think public health is far behind in the informatics world.

D. Behind in Technology

Participants assumed that, ideally, public health should utilize modern technology to facilitate public health practice, but they assumed that, in reality, the field struggles to incorporate new technology.

Participants saw the adoption of new technologies as the ideal and equated technology with progress, greater efficiency, and new ideas. Yet, at the same time, participants consistently suggested that in reality, because of the field's lack of resources and savvy, the adoption of new technologies is highly improbable.

Participant: Ideally, when you're doing your work, you want your work to be as seamless and as easy as your smartphone—kind of all-in-one, handheld, quick, responsive. You dream it, it happens. Unfortunately, in a public health agency with limited resources, the ability to purchase these wonderful, inventive, technology type stuff is limited. So, we just don't have the ability to, you know: click it, modify it, change it, make it happen.

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Participant: We're using Skype [to interview public health job candidates]. We had to get all the waivers, etc. I mentioned [to the candidate] at the beginning of the interview that this was the first time we're doing video interviews, and he should let me know if there are any challenges with seeing me or sound. And he said, "It took me awhile to find my Skype I.D. because I haven't used Skype in years." His point was that he uses FaceTime. So, to him, this is old technology. To me, we're cutting edge. It was a reality check: my impression of using current technology—and maybe the federal government's standard—was quite different.

E. Limited Data Sharing

Ideally, participants assumed, data should be seamlessly shared across organizations and departments. However, understandings of the reality of data sharing were quite different.

Participants consistently reported that public health does a poor job of integrating data systems, and emphasized that data sharing is a major problem in the field. They often used terms like, "integrated system" and "sharing," suggesting an overall preoccupation with the idea that data should be shareable, and that systems should be in place to facilitate the sharing of data across different areas of public health practice and administration. The underlying assumption here was that data *ideally should be shared, but in reality, there are factors that constrain this practice.* For example, participants focused on siloing and multiple funding streams as the major impediments to data sharing. Data sharing was an area where the

ideal/real tension was most palpable. Participants simultaneously assumed that integrating data systems is an urgent necessity *and* that, in practice, it remains an unrealistic ideal.

> **Participant:** We have lots of surveillance systems. We've got lots of registries. The biggest issue, I think, is they don't talk to one another. Even [systems] that we've owned—public health [systems] that are not really healthcare delivery—they're all built in silos, and they don't talk to one another.
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> **Participant:** If we had some sort of collection—a national collection database—I think that that would be helpful. Now, it's pie-in-the-sky thinking.
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> **Participant:** I can't [provide data for colleagues] electronically other than send them a spreadsheet in the electronic format.
> **Researcher:** So, ideally would that not be required?
> **Participant:** That's right, it'd be connected. […] So, that's in an ideal world. I know we move in that direction, but there's still a lot of disjointed information systems where we could definitely get efficiencies if we could get them connected.

F. Systems Quality vs. Systems Quantity

There was an underlying assumption that, in practice, the field's attempts to improve data management usually result in creating *more* data systems rather than *better* data systems. Participants saw the profusion of data systems as detrimental to their work, because these siloed systems require burdensome, post-hoc coordination that is difficult and time-consuming, if not impossible. However, participants thought that creating better data systems that focused on coordination at every stage of the data management process would result in better outcomes. Thus, participants saw the ideal as a small set of high quality integrated data systems that "talk to each other" and allow data to be shared easily and accurately. They juxtaposed this ideal with what they saw as the reality—an excess of disconnected and uncoordinated systems.

> **Participant:** We're trying to create standard methods by which data gets to the CDC and gets provisions to programs that don't create a tremendous burden but do provide useful information. We have multiple systems by which CDC programs get their data. It's usually siloed systems and the states have to integrate it into multiple systems to get it to CDC programs. Which is very burdensome.

Implications

1. **If not carefully framed, *Ideal vs. Real* thinking may marginalize public health informatics.** Because informatics is designed to achieve aspects of the *ideal* vision of public health—seamless information sharing across agencies and programs, integration of data systems, and decision-making that is responsive to on-the-ground needs—there is a danger that public health professionals will assume that public health informatics is another "pie-in-the-sky" aspiration. In

short, due to ideal vs. real thinking, public health informatics is likely (without careful framing) to be classified in the "ideal" part of this dichotomy and thus considered impractical and unlikely to work in the real world of public health. This will marginalize and undermine support for public health informatics. Communicators need strategies to help public health professionals understand how informatics can *realistically* achieve public health goals, and help professionals envision *how* informatics can become a core part of the field of public health. These strategies should explain how specific public health informatics practices can bridge the gap between ideal and real.

2. **The recognized need for data sharing is a productive starting point.** The recognition of data sharing as one of the field's major weaknesses suggests an opening for well-framed messages about public health informatics. If public health informatics can be framed as a vital part of a pragmatic solution to this problem, support is likely to be high for public health informatics work. Furthermore, given worries that new systems create more problems than they solve, communicators should stress public health informatics' role in *better integrating systems* rather than *creating new/more systems.*

II. Models of Public Health Informatics

Participants were asked about public health informatics at the very beginning of the interview and then again, in greater depth, near the end of the interview. Participants showed a basic degree of familiarity when asked about the term "public health informatics," and these initial responses suggest some alignment with the expert messages distilled above. This alignment suggests that *fostering a basic, high-level recognition of public health informatics is not the major challenge for communicators.*

However, as conversations moved beyond explicit questions about what "public health informatics" is and into topics related to informatics—data, information, technology, and decision-making—public health informatics completely dropped out of conversation. That is, participants could discuss a set of issues related to public health informatics, such as data collection, systems, and standards, but they did not bring public health informatics into the conversation as they discussed these concepts with the interviewer. As a result, *public health informatics remained largely invisible except when most explicitly cued.*

The absence of the field of public health informatics in conversations about topics in which informatics is centrally involved is important. It suggests that in spite of a basic familiarity with the term, there exist no strong, consistent linkages between public health informatics and the key areas of public health practice that this field works to address. Furthermore, this analysis revealed ways of understanding public health informatics that contribute to the difficulty in drawing linkages between this field and the issues and goals that constitute its work.

Below, we lay out the shared understandings of public health informatics that emerged from this analysis and explain how these ways of thinking contribute to the invisibility of this field in people's thinking more generally about public health concepts.

A. An *Informatics = Data + High Tech* Model

When asked to define public health informatics, participants generally characterized the field as the application of technology for data management. Importantly, they did not suggest that informatics was essentially the same as IT. Rather, they understood informatics as primarily about data, and they understood modern data management strategies as necessarily involving technology. So although participants assumed that IT is an important *part* of informatics, they saw informatics as something larger —as a field positioned at the nexus of data, technology, and information systems.

> **Participant:** To me [informatics] means the collection, handling, analysis of data typically through electronic means. I think of "informatics and information technology" as being inseparable partners. If someone is sitting on the phone and filling in a spreadsheet by hand, I wouldn't think of that as public health informatics.
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> **Researcher**: I'm interested in your top-of-mind thoughts on public health informatics. Is that something that would ring a bell to you, or something that you work on or with?
> **Participant:** We're in a technologically advanced society right now. Technology is a big deal. It ranges everywhere from surveillance activity to gathering data to address health impacts.

Regarding data, participants overwhelmingly saw data as a means to solve public health problems and, secondarily, as a way to motivate the public or policymakers to make better decisions. Also, it is worth noting that participants consistently assumed that data should be collected and analyzed with specific goals in mind.

> **Participant:** If you know the problem exists and it's not fixed, then what's the point of collecting data? There is no point. You don't collect data just to sit on it, just for it to be there. […] What's your participation counts for the last month? How many people are walking through the doors and getting our services? That's the only way that you can determine if you are actually helping the people who really that need it, or if you could be doing more.

To understand why public health informatics so frequently vanished from participants' talk—*even though they could describe aspects of what informatics is*, as outlined above—we must look beneath definitional understandings to deeper assumptions about what public health informatics is and is not.

B. The *Informatics as Tools without Technicians* Model

Professionals thought about informatics as a *set of tools*, or *as a system,* not a coherent field or a science. That is, public health informatics was associated with an "interoperability handbook," a database, or an electronic infrastructure; it was not the *theory* behind the handbook, the *design* of the database, or the *planning* of more efficient infrastructure.

Participants often equated public health informatics *with a data system*, rather than as a *field of expertise* in which scientists apply specific skills and insights to design and manage systems. In this pattern of thinking, *the work of informatics professionals disappeared behind the automated work of the system.* Thus, because public health informatics is not thought of as a unique field, it does not have—and does not need—a clear role in public health, in contrast to other subfields.

> **Participant:** After you do the interfaces and get all that together I think the costs are minimal after that, because then it's just computers talking to computers. […] Hopefully the next 10 years sets something up that we can collect that data without human interaction.

This understanding was also reflected in participants' focus on systems, and lack of awareness of *informaticists* or professionals trained in informatics.[10] While participants frequently emphasized the need to update data systems, modernize technology, and improve data flow, they never spoke clearly about *who* in the field of public health does this work. Participants typically could not identify informaticists they worked with or describe what an informaticist might do, which stood in strong contrast with their knowledge of, for example, epidemiology. Participants rarely suggested that public health departments and agencies should support the training and hiring of informaticists or increase their organization's competency in informatics.

> **Researcher:** So, if CDC were providing the leadership, what kinds of professionals would be needed to do this?
> **Participant:** I think anyone with a health background who has a clinical health background. So, it could be doctors, nurses, pharmacists, nurse practitioners, physicians—that kind of person—who then go on to get an information technology background. Epidemiology and statistics would be the skills that I think would be most important to have.
> —
> **Participant:** There are questions that people ask but I don't think that we are good at collecting data consistently. And so [various agencies] may have a number or a perspective on that question. But I don't know of anyone who is bringing all of those important questions together—or putting answers to that question together.

The understanding of public health informatics as a set of disparate tools, rather than as a coherent field of expertise, helps explain why informatics vanished from participants' talk: it is not seen as a unique *field* in which *informatics professionals* bring their social science and data science expertise to bear on important public health questions and challenges. In this way, the *Informatics as Tools without Technicians* model obscures the field of practice that brings concepts of data, technology, information, and decision-making together. As a result, informatics does not play an organizing role in thinking about these issues, and easily falls out of mind.

C. A Problematic Example of Public Health Informatics

Given the shallow understanding of public health informatics *as a field of expertise,* participants struggled to think of examples of this work. When participants were able to come up with an example of informatics, they typically mentioned electronic health records (EHRs).[11]

Generally, EHRs were considered part of clinical practice and a product of private industry and not as a part of public health work. The fact that the most accessible example of public health informatics is not seen as within the domain of public health is clearly problematic for those messaging about *public health* informatics. The EHR example was also problematic because it reinforced participants' senses of public health's lack of capacity for cutting-edge technological innovation. Participants noted that innovative EHRs are the product of the commercial marketplace, in which the institutional constraints of public health (e.g., silos, scarcity, lack of responsiveness) do not apply.

> **Participant:** Data systems and the electronic medical records system of the clinical world are more sophisticated.
>
> —
>
> **Participant:** So we are currently looking at electronic medical records […] because there's no public health electronic medical records system, so to speak.

Implications

1. **Generating a basic understanding of public health informatics is *not* a key challenge.** At a very general level, public health professionals are familiar with public health informatics and can define the concept as involving both data and technology. Furthermore our analysis shows that public health professionals tend not to conflate public health informatics with IT. Thus, generating a basic familiarity with the term does not seem to be a major communications task.

2. **The *Informatics as Tools without Technicians* model makes the field and the work of informatics invisible.** To raise the status of the field and enhance training and recruitment, communicators need to cultivate understanding of public health informatics as a specialized *field of expertise* in which *professionals*—not just systems—perform important functions that promote the goals of public health. Focusing on systems and not on an integrated field of practice mutes attention to the science and expertise that is at the core of public health informatics.

3. **Unfamiliarity with the concrete details of public health informatics reinforces the field's invisibility.** While professionals do have an abstract understanding of public health informatics, their inability to come up with an apt example of public health informatics demonstrates limited understanding of what informatics actually involves in practice. Communications need to concretize professionals' understanding of what public health informatics does in practice in order to bring the work of the field into better view.

4. **Terminology issues weaken communications efforts.** Participants rarely used the term "public health informatics" and almost never used the terms "informatician" or "informaticist." (In contrast, however, they referred to "epidemiologists" or "epi's" frequently.) The failure of these terms to become part of professional discourse makes it difficult to generate understanding of public health informatics as a field.

5. **Public health professionals already understand that data should be collected and analyzed for a purpose.** Professionals seem to value data for how it can be used, and in terms of specific goals that its use can help achieve. This suggests that shifting or building basic assumptions about what data is used for is not a central component of more effectively communicating about—and raising understanding of—public health informatics.

Communications Challenges

Mapping the gaps in understanding between public health informatics experts and public health professionals reveals *overlaps* as well as *gaps*.

The following overlaps represent the knowledge and assumptions that informatics experts and public health professionals share. These overlaps represent areas of understanding that do not require additional work. As such, knowing where understandings overlap helps communicators prioritize communications tasks and optimally use resources. In addition, as areas of shared understanding, overlaps represent ideas that messages can build on to expand the field's thinking about the work and importance of public health informatics.

- **Public health informatics is about both data and technology.** Professionals understand that public health informatics involves the use of technology to collect and manage data, and they tend not to conflate public health informatics with the IT field. At this basic level, their definitions are similar to those of public health informatics experts.

- **Data need to be gathered and managed with practical goals in mind.** Experts and professionals share the viewpoint that data should not be collected "for data's sake"—rather, there needs to be a purpose guiding data collection and analysis.

- **Integration of data systems is crucial.** Professionals are attuned to the need to integrate data systems. They are not well versed in the details of how these systems work, or how they would be integrated, but they do understand that public health practice depends on the right people having the right information at the right time. Furthermore, they understand that meeting this goal requires that systems work together.

In addition to these overlaps there is a set of gaps in understanding that represent fundamental communications challenges and tasks. In the Recommendations section that follows, we respond to and seek to address the following challenges:

- **Public health informatics is not understood as a scientific field.** Experts understand public health informatics as an emerging field that facilitates public health's goals of better decision-making and improved population health. While public health professionals are familiar with public health informatics at a very general level, they do not see it as a *science*—a social science, a data science, an information science, etc.—or even as a field of practice and expertise. This fundamental difference in understanding lies at the heart of each of the gaps identified below and is the central communications challenge on this issue. **Communications task: Generate an understanding of informatics as a scientific field of *practice and expertise.***

- **Informaticists are invisible**. Experts think of public health informatics in terms of the *scientists who do the work and the expertise they use in doing it,* rather than the systems they design and manage or the standards they develop. Public health professionals think about data, systems, and technology, but *not* scientists or their expertise. **Communications task: Help professionals understand informaticists' critical role in making information systems work more effectively.**

- **The role of public health informatics in addressing how people *use* information is not recognized.** Experts strongly emphasize that public health informatics is a social science that considers the *users* of information at every stage of data collection and sharing—users such as clinical professionals, scientists, analysts, and government officials. Public health professionals, however, do not recognize the importance of studying how people interact with data systems or ensuring that those systems can accomplish their goals. **Communications task: Emphasize the complexity of users' needs and show how public health informatics, as a social science, plays a key role in addressing these needs and solving problems.**

- **Terminology is unfamiliar.** Experts share a language for talking about their field, which is generally unfamiliar to public health professionals. Most importantly, professionals are *not* familiar with the terms "informatician," "informaticist," or "informatics specialist." Research participants never used or repeated any of those terms as they talked. This challenge is complicated by a lack of consensus among experts on this terminology. **Communications task: Develop and use a consistent term for informatics professionals that can facilitate talk about the field of public health informatics and the professionals who do this work.**

- **Understanding of *how* systems can be integrated is limited.** Public health informatics experts understand the complex factors involved in systems integration. Professionals understand that systems *should* be integrated. However, they do not understand the complexity of what has to happen—for example, the design of a system, the creation of standards, the consideration of the users, the technical details—in order to integrate information systems. This limited understanding makes system integration seem overwhelmingly complex, which fuels fatalism by making integration seem like an unachievable task rather than a practical challenge. **Communications task: Explain how public health informatics can overcome complex challenges to integrate information systems.**

- **There is a not a *concrete* understanding of public health informatics.** Experts have years of experience and an intuitive understanding of detailed examples of how public health informatics works in practice. While professionals can define aspects of public health informatics at a general level, they lack a concrete understanding of what public health informatics work *is* and what informaticists *do*. **Communications task: Make the work of public health informaticists clear and concrete.**

- **Fatalism leaves no space for public health informatics.** While experts note informatics' capacity to solve longstanding problems within the field of public health, public health professionals assume

that these problems are inherent characteristics of the field and not amenable to change. Ideal vs. real thinking makes the promises of public health informatics seem like a pipe dream and marginalizes the work of the field. Fatalism about public health's inability to innovate and to overcome obstacles such as silos and lack of funding impedes full engagement with—and investment in—public health informatics. **Communications task: Counter fatalism to boost public health professionals' belief in what the field can accomplish.**

Initial Reframing Recommendations

The recommendations in this section are designed to address the challenges described above.

It is first important to note that while the strategies provided below are based on findings from prior FrameWorks research, framing theory more generally, and the research described above, these recommendations have not yet been empirically tested to determine how—and how well—they work to expand understanding of and support for public health informatics among members of the wider field of public health. An empirical approach to communications requires this kind of testing in order to gauge the effect of frames in relation to specific communications goals. The recommendations below, therefore, represent initial recommendations and potential hypotheses to explore in future research.

The meta-recommendation that emerges from this research is the need to develop a **Core Story of Public Health Informatics** to address the complex and interrelated challenges of communicating this field. A Core Story is a communications platform based on empirical research and organized as a narrative. It is flexible—communicators can use it creatively in different contexts for different purposes and with different audiences—but even as it takes different forms, it maintains a basic underlying structure. In this way, a Core Story derives its power both from its constituent tools, including Values,[12] Explanatory Metaphors,[13] and Explanatory Chains,[14] and from the way that these tools are brought together and organized to tell a coherent story.

In addition to having a tested Core Story, FrameWorks' past research, as well as that of various social movement scholars,[15] suggests the importance of a having a larger strategy through which this narrative can be disseminated. Public health informatics experts need both the *content* of a new story about their field and how it works as well as a strategy for *using* this story to change understandings of public health informatics. The power of a Core Story relies on it being used *often and consistently.* Therefore, the success of the larger strategy will depend on public health informatics experts and insiders promoting the Core Story in their activities as communicators, and leveraging communications opportunities outside of their immediate sphere to disseminate the story. Only through consistent deployment in strategic venues and in creative ways can communicators change the professional discourse about public health informatics. The Public Health Informatics Institute, with its extensive networks, partnerships, and influence, is ideally positioned to do this.

The Core Story will need to address the following key questions:

1. Why is public health informatics important?
2. What is public health informatics?
3. How is it done and who does it?
4. What problem does it address?
5. What outcomes does it improve and how does this work?

Below we lay out a set of framing tools that can be brought to bear in answering these five questions and building an effective Core Story.

Why is public health informatics important?

Even before defining the topic, it is important to set the stage for thinking about the importance of public health informatics. Values are effective frames for this task and can be used to answer the question of why public health informatics matters.

Recommendation: Use the values of *Progress, Ingenuity,* and *Pragmatism* to provide a sense of the importance of public health informatics and overcome fatalistic thinking.

Values are powerful frame elements for shifting attitudes and orienting people toward productive action.[16] The values of *Progress* and *Ingenuity* have demonstrated effectiveness in past research[17] as ways of addressing fatalism, and we hypothesize that these values could also be useful for public health informatics, where issues of fatalism represent a major communications challenge. These values should help promote a sense of efficacy and cultivate thinking about how public health informatics could overcome stubborn obstacles in the larger field of public health (such as siloed systems, for example). Below we provide an example of how these values might be used.

> Public health works to make consistent progress toward better population health. To achieve this in a constantly changing world, public health practice depends on innovation and ingenuity. Developing, testing, and carefully implementing new solutions helps the field solve problems and move positive outcomes forward. Public health informatics is an engine of ingenuity within public health—informaticists work to solve problems and figure out new ways to coordinate and share information by designing state-of-the-art data systems and harnessing new technologies to improve public health. These kinds of innovative solutions are exactly what we need to move public health work forward.

These values are important because professionals believe that public health is *not* making the progress that it *should*. Public health informatics can be positioned as part of the fix—as an ingenious solution that can help the field live up to its potential.

The value of *Pragmatism* is another potentially useful way to counter unproductive patterns of thinking about public health. *Pragmatism* orients people to see problems as solvable through clear, realistic, and common-sense actions. This value will help position public health informatics as a set of pragmatic solutions to real-world problems rather than ideal pipe dreams. The following is an example of how this value might be used:

> We need a common-sense, pragmatic approach to solving the problems that we face in the field of public health. Public health informatics can be part of this approach—it takes on difficult problems (like the silos of the field) by developing new and practical ways to bridge the gaps between agencies and across systems so that public health can operate more efficiently and effectively, and implement quality improvements. To do this, we need informaticists who are trained to look at all the aspects of a complex problem and coordinate solutions that have the best chance of improving public health practice and managing change—across all of public health.

Communicators should weave the gist of these values into their communications. The key to this strategy is to connect public health informatics with a broader value—a guiding principle about why these topics matter—and address the challenge of fatalism by boosting senses of efficacy. Again, we emphasize the importance of empirically testing these values to determine their effectiveness in addressing the challenge at hand.

What is public health informatics?

Recommendation: Develop and use consistent terminology for those who practice public health informatics.

The Core Story must employ consistent shared language and terminology. Every professional field has its own vocabulary—"inside baseball," as one expert put it—and this is certainly the case for public health informatics. Communicators must keep in mind that while some language might be shared in the larger public health field *(data, integrated systems, information sharing,* etc.), much of the language specific to public health informatics is not. Communicators must make sure that jargon is translated clearly in wider-reaching communications and that new terminology is used consistently across messages.

Perhaps the most crucial task is to design a name for "a public health informatics professional." This task is a key part of highlighting the work, the importance, and the overall role of the informaticist. While it may not be feasible to rename the field of public health informatics—in fact, it is too entrenched and familiar—there does seem to be an opening to rename the professional role, largely because of people's total lack of familiarity with currently used terms. A single term must be chosen and used consistently across all communications.

Recommendation: Consistently use a clear definition that emphasizes public health informatics as a *field of practice* and *source of expertise.*

In addition to a name for those who practice public health informatics, a short and clear definition of public health informatics as a field of practice and expertise—a definition that speaks to professionals'

patterns of assumptions about the field—needs to be used consistently. Based on our research, the following is our first attempt at such a definition.

> Public health informatics is the **science** of managing public health information. **Informaticists** are public health professionals trained to ensure that data are shareable, and to design and implement the **integrated systems for sharing health data** that are crucial to public health practice and high-level decision-making. They address **the complex needs of public health professionals** who use these systems every day to collect, scrub, analyze, and share data in a safe and timely way. **People** in public health informatics solve problems by figuring out the best ways to apply technology to make sense of massive amounts of data and help other professionals see the stories that these data are telling. Their work supports other public health professionals by improving **decision-making** and increasing the field's ability to improve population **health outcomes.**

This definition does not need to be used exactly as written here, but the "effectiveness factors" or key ingredients in the definition are the following:

- **Public health informatics is a field of practice and a science.** The definition must clearly mark public health informatics as a field of practice and a source of expertise.
- **Informaticists integrate data systems and apply technology to solve data problems.** The definition must highlight the central role of *informaticists* and link the work of these professionals to integrated data systems, and more broadly, to the application of technology to data. This aspect of the definition will leverage the importance that public health professionals already attribute to these systems and to better uses of technology.
- **Informaticists meet the needs of those who rely on and use data.** The definition must introduce the informaticist's role in addressing the needs of the users of these systems and in helping them do their work better.
- **Informatics performs functions that support the larger public health mission.** The definition should emphasize how the work of public health informatics advances the ultimate goals of public health—how using data to see the big picture and improve decision-making are keys to improving public health practice.

How is public health informatics done and who does it?

This is an especially important part of the Core Story, because it speaks to the most difficult challenge in communicating about public health informatics: helping people understand *how* this work is done and *who* does it.

Recommendation: Develop and consistently use a strong Explanatory Example of public health informatics.

Our research suggests that, in the field of public health, the most dominant example of public health informatics is electronic health records. The frequency with which participants brought up this example points to the power of examples as a frame element. However, this particular example is problematic because its application does not lead to understandings of public health informatics that are in line with the messages that experts want to be able to communicate about the field.

The problems with this particular example, coupled with its stickiness, suggest the importance of developing a new Explanatory Example that leads to ways of thinking about public health informatics that are more in line with expert messages. This requires conceptualizing what one expert called "a marquis issue" that serves as a way of illustrating and explaining how public health informatics is done, who does it, and what the field has to offer. To be effective, the example should do the following:

1. **Establish a clear and essential role for informaticists.** The example should be an activity or set of activities done by informaticists—it should illustrate a field of practice rather than a product that this field creates (e.g., electronic health records, databases).

2. **Focus on successful integration of systems.** As described above, we know that public health professionals highly value shareable data and the integration of systems, but that they do not connect this activity to informatics. It seems promising to use the example to highlight how public health informatics accomplishes this goal.

3. **Show a case where informatics work helped overcome a well-understood public health challenge and explain how this process worked.** This might be public health informatics facilitating collaboration across silos, securing funding to achieve an important task, or using cutting-edge technology to achieve core public health goals. It is important to note that the example should not only clearly show the positive outcome that resulted, but should explain *how* contributions from the field of public health informatics led to the improved outcome.

We offer the example below to show how an Explanatory Example might work. This example is inspired by an example mentioned by experts.

Bridging the gaps between data systems to enhance public health

A key goal of public health informatics is to develop and implement integrated data systems in order to find innovative solutions to public health problems like the recent Ebola outbreak that reached the U.S.

To move quickly to stop an infectious disease outbreak, clinicians and public health workers need complete, accurate, and up-to-the-minute information. And in the case of Ebola, it isn't enough to know if a person *has* Ebola—it is necessary to know a person's *risk* of having it, to make sure that others aren't exposed and the disease does not spread.

This is where public health informatics is crucial. To provide this information requires integrated data systems—and this is a complex endeavor that requires expertise spanning data science, technology, and social science. Informaticists must assess the challenges faced in linking data systems—for example, what sources of data are necessary, the forms in which data are collected, the needs of the people working with the data, and the limitations of current technology. Then they must design and test ways for different data systems to communicate and exchange data. For example, to stop an Ebola outbreak, it is necessary to make sure that data from emergency rooms, doctors' offices, pathology laboratories, and public health agencies are all complete and coordinated. For this coordination to work effectively, public health informaticists must develop "interoperability standards." These standards allow multiple data systems to "talk to each other" seamlessly, without duplication or error. If a patient is complaining of fever, this symptom could mean many things—but emergency room data showing a new fever symptom, considered alongside other medical record data on the patient's travel history, could trigger an Ebola warning. Triggering an Ebola warning can catalyze special clinical procedures for the patient, alert the hospital to ensure the safety of patients and staff, and notify the public health officials so that they can determine who else might be at risk and stem the progression of the disease.

In this way, public health informaticists have a key role to play in improving infectious disease surveillance and protecting population health.

It is important to note that while the content of this example must be tested to determine its effectiveness as a communications tool, this example makes informatics visible, connects it to the goal of system integration, and explicitly demonstrates the role of informaticists in this work. Communicators could expand upon this example and highlight other more specific examples of concern to public health.

Recommendation: Use Explanatory Chains to show how public health informatics can help improve public health outcomes.

Explanatory Chains—clear explanations of cause and effect designed to help people understand concepts, who is involved, and what solutions are possible—are additional tools that can help public health informatics professionals increase understanding of their field and its work.

An Explanatory Chain requires the following parts:

1. **Initial Factor: What is the original cause of the problem?** Effective chains provide appropriate background information on the challenge.
2. **Mediating Factors: What does the initial factor cause?** The mediating factors link the initial factor to the final consequence through explanation. It helps people see that circumstances are not inevitable—that problems have causes and solutions.
3. **Final Consequence: What are the effects?** The final consequence is the effect, result, or impact.
4. **Solutions: What can we do?** An effective Explanatory Chain sets up communications about solutions.

Explanatory Chains could be used to help people see how public health informatics help solve larger-scale public health problems. Below we provide an example of what an Explanatory Chain could look like, loosely adapted from an example mentioned by an expert interviewee:

> To make progress toward better population health in a constantly changing world, public health practice depends on innovative ways of solving problems *(Value: Progress and Ingenuity*). For example, we know that the rising rate of obesity is an important public health problem in this country. However, to *understand* this problem, it is crucial to draw data from not just clinical databases, but many different systems. We need data about the built environment, neighborhood crime, air quality, access to food, etc., and we need data that show how these factors interact. The problem is that, currently, our data systems are not well integrated (*Initial Factor*). In public health, siloed programs, the way that initiatives are funded, and the data collection requirements of different systems all converge to create a set of data systems that do not talk to each other (*Mediating Factor*). As a result, we don't have all the data we need for the kinds of analyses that would help us understand the problem and how to solve it (*Final Consequence*). This is where public health informatics can help. Informaticists think about how people use data to solve big problems, design integrated systems that enable sophisticated analyses, and apply cutting-edge technology to do all of this in a timely way (*Solutions*). By integrating multiple data systems, public health informaticists make it possible to analyze data in new ways, which in turn makes it possible to understand a problem and see how to address it effectively (*Solutions*). This type of common sense problem solving supports public health's goal of improving population health (*Value: Pragmatism*).

Recommendation: Develop Explanatory Metaphors to explain key aspects of public health informatics.

Three important challenges identified in this research would likely be well addressed with an Explanatory Metaphor. These challenges include the lack of understanding of public health informatics as a scientific field, the invisibility of informaticists, and the complex needs of information users.

An Explanatory Metaphor is distinct from the strategies described so far because it explains public health informatics through a comparison to something that is highly familiar to professionals (and even members of the public). Because it relies on deep conceptual links between the familiar and the unfamiliar, an Explanatory Metaphor does not require lengthy explanation or detailed background knowledge to convey the desired message.

The public health informatics experts interviewed for this research generated a number of metaphor "source domains," or metaphorical ways to explain public health informatics, as they spoke about the field (for example, "an ecosystem of information" or a "toolbox"). These domains represent a starting point for research that would involve generating and testing a wider range of potential metaphors in order to find the most effective and salient ways of using metaphor to explain aspects of public health informatics.

What problem does public health informatics address?

This research suggests that public health informatics addresses a problem that is salient to public health professionals—the need to have usable, integrated data systems. People do not need to be convinced that there *is* a problem but they do need help in understanding what causes this problem, seeing how it works and, most importantly, connecting it to the field of public health informatics.

Recommendation: Highlight a familiar problem—the importance of integrated information systems—and connect this issue to the work of public health informatics.

Public health professionals recognize that the lack of integrated information systems limits the effectiveness and efficiency of the field. Communicators should point to this widely understood problem and position public health informatics as an essential solution, to make the connection between the need for integrated data systems and public health informatics *explicit.*

Highlighting the need for integrated systems will only be an effective strategy if it is part of a broader narrative that generates a sense of efficacy and explains *how* systems can be integrated in practice (i.e., that the problem can be solved). Without a narrative that cultivates understanding of systems integration, discussions of the lack of integrated systems are likely to reinforce fatalism and lead professionals to focus on the limits to what public health can realistically achieve rather than on the potential to solve this issue and move the field forward.

Both the Explanatory Example and the Explanatory Chain above attempt to highlight this problem, and communicators can develop additional versions that are more or less specific, depending on their needs and their audiences.

What outcomes does this improve and how does this work?

It is important to end the Core Story narrative with descriptions of positive outcomes that have resulted from public health informatics work. These outcomes should be connected to the overall mission of public health, to emphasize the common, shared goals of the field and return to the question, "why does this matter?"—leaving public health professionals with a clear understanding of the importance and potential of public health informatics.

In general, effective solutions messages must have the following three characteristics:

1. The solution must fit the scope of the problem. In other words, do not let the sense of the problem outweigh the proposed solutions. A problem that seems inadequately addressed will cue fatalistic thinking.

2. The solution must provide a sense of efficacy in two respects: first, it must demonstrate that a larger issue can be fixed; second, it must show how individuals in public health are empowered to fix these issues.

3. The solution must be presented with sufficient explanation to show exactly how the solution was achieved (and how public health informatics was involved).

An example offered by an expert interviewee, and mentioned in the expert story, illustrates this well. The expert described how in Sierra Leone, the Ministry of Health noted that rates of infant and maternal mortality were high, but the Ministry had no data to draw upon to make decisions about how to spend the nation's limited resources. There were not even any data on mortality rates by district. (Thus, in this particular example, the problem was *not a lack of integration of data systems*, but rather, *no data systems.*) The expert went on to describe how informaticists developed a data collection system that could be used in an environment where literacy was low, electrical power and cell phone coverage were lacking, and timely data were crucial. By training locals to place rocks in designated boxes as a way to count and track infant and maternal mortality, informaticists could report these data to the Ministry. The government could then make decisions about allocating resources for clinics in districts where mortality rates were highest, and could immediately begin to address this problem most effectively.

This example is effective because it shows, even in a very brief retelling, how a problem was adequately addressed, how people took action, how the solution was specifically implemented and achieved, and how health was improved. This is material that is often absent in communications about public health informatics—which makes sense, as the subject matter of the field is quite technical—but is crucial for making the role of public health informatics and its connections to public health more visible.

Conclusion

In this report, we have outlined a set of messages that public health informatics experts want to be able to communicate to the wider field of public health. We have identified the pervasive patterns of thinking that public health professionals bring to bear in understanding public health informatics and the key aspects of this field. The ways in which these two areas of understanding overlap and diverge have important implications for communicating about the emerging field of public health informatics, and these implications enable us to outline an emerging Core Story strategy for those seeking to expand understanding of—and increase support for—public health informatics.

Fortunately, public health professionals seem, in many ways, predisposed to hear about how public health informatics complements, enhances, and supports their own work. With this in mind, a key general recommendation is to *explicitly mention public health informatics in all communications,* including blog posts and social media as well as scholarly articles and conference presentations. The power of repetition as a communications strategy is well documented in the social science literature.[18] We suggest here that public health informatics communicators make full use of this feature of effective messaging.

The report has offered concrete recommendations—a flexible definition of public health informatics, guidance on developing Explanatory Examples, and a template for Explanatory Chains that communicators can use to create effective messages about public health informatics. Recommendations for strategies that require further research are also outlined. These include developing Explanatory Metaphors and designing new terminology for public health informaticists. FrameWorks' approach to evidence-based communications takes seriously the fact that these tools need to be developed for specific purposes and that they must be carefully tested determine if and how they work.

This research, and the recommendations that follow from it, present an opportunity for communicators to change the professional discourse of public health—and to make visible the emerging field of public health informatics.

Appendix: Research Methods

Expert Interviews

Summary: To distill the expert view on public health informatics and sketch the untranslated story of the field, FrameWorks researchers conducted 13 one-on-one phone interviews with public health informatics specialists from November to December 2014. FrameWorks scheduled the interviewees in collaboration with the leadership of the Public Health Informatics Institute and their colleagues. The final list of expert participants was designed to reflect the diversity of the field, and included public health informatics specialists and practitioners from diverse areas, including academia, government, and the not-for-profit sector. The interviews lasted approximately one hour, and with participants' permission, they were audio-recorded and subsequently transcribed for analysis.

Interviews: The expert interviews consisted of a series of questions designed to characterize expert understandings of how public health informatics is defined, how public health informatics is situated within the larger field of public health, how public health informatics work is conducted on different scales and in different institutional contexts, examples of public health informatics work, and how the field is changing. The interviewers employed a series of prompts and hypothetical scenarios designed to challenge expert participants to explain their research, experience, and perspectives, and to break down complicated relationships between various concepts and explain important principles of the field.

Analysis: To distill the interview data into a coherent single story, researchers employed a basic grounded theory approach in which the interviews were extensively coded, and patterns in the coding were gathered into themes and then categorized. Negative cases were used to refine the categories and themes. This resulted in a synthesis of the most prominent and widely held themes from the interview data. Overall, the categories included the following, phrased as questions: (1) What is public health informatics? (2) Why is public health informatics important? (3) What distinguishes the field of public health informatics? (4) What challenges does the field of public health informatics face? The themes pulled from the interviews served to answer these questions.

Following this initial analysis, FrameWorks researchers conducted an "expert feedback session" in January 2015. During this session, a group of public health informatics specialists and communications specialists were assembled to provide additional input and feedback on results emerging from the analysis of one-on-one interviews with experts. Session participants were asked to identify important concepts not reflected in the results, winnow out results that were not of central importance, and refine the themes that emerged from analysis of interview data.

The result of this process is the untranslated expert story of public health informatics.

Professional Cultural Models Interviews

Summary: Following the expert interviews, FrameWorks researchers conducted separate interviews with professionals working in public health fields. These professionals are not experts in public health informatics per se, but their work in program administration, policy, etc., inherently involves aspects of public health informatics, and, as such, their work is influenced (to various degrees) by the concepts discussed by experts. The overall goal of these interviews was to distill the data into a description of how these professionals understand public health informatics, what they know about it as a field, and how it relates to their work. FrameWorks researchers conducted 21 in-person, one-on-one interviews—in Washington, D.C., and Atlanta, Georgia—in March and April 2015. As with the expert interviews, FrameWorks compiled the list of interviewees in collaboration with the Public Health Informatics Institute and their partners. The final list of participants was designed to gather the perspectives of professionals working at different levels across various fields of public health (e.g., program administrators, leaders of not-for-profit organizations). The interviews lasted approximately one-and-a-half hours and, with participants' permission, were audio-recorded and subsequently transcribed for analysis.

Interviews: The interviews allowed the researchers to explore the broad patterns of assumptions—professional cultural models—that participants use to make sense and meaning of information related to their field of practice. Recruiting a range of people, and allowing sufficient time for participants to explore the topic areas of the interview in a nonlinear, semi-structured style, increases the likelihood that the professional cultural models we identify represent shared patterns of thinking about a given topic.

The semi-structured "professional cultural models interviews" are designed to elicit ways of thinking and talking about concepts related to a larger topic of inquiry—in this case, what professionals think about public health informatics, and what they think about concepts that are closely related to public health informatics practice. The researchers approached each interview with a set of topic areas to be covered—including the definition of public health informatics, information and policy, data (collection, analysis, sharing, etc.), technology, and decision-making—but left the order in which these topics were covered largely to the participants. As the goal of these interviews was to examine the professional cultural models that participants use to make sense of these issues in the context of their work, it was important to give them the latitude to introduce concepts and relationships between concepts that were touched off by the researchers' questions. Participants were encouraged to pursue any tangents and examples from their work that they judged relevant to the topic. The topic of public health informatics was explicitly cued by the researcher at the beginning of the interview, and again at the end of the interview.

Analysis: FrameWorks researchers adapted analytical techniques employed in cognitive and linguistic anthropology to examine how participants understand concepts and principles related to public health informatics. First, we identified common, standardized ways of talking across the sample to reveal organizational assumptions, relationships, logical steps, and connections that were commonly made throughout an individual's interview and across the set of interviews. In short, our analysis identified patterns both in what was said (how things were related, explained, and understood) as well as what was not said (assumptions).

About The FrameWorks Institute

The FrameWorks Institute is an independent nonprofit organization founded in 1999 to advance science-based communications research and practice. The Institute conducts original, multi-method research to identify the communications strategies that will advance public understanding of social problems and improve public support for remedial policies. The Institute's work also includes teaching the nonprofit sector how to apply these science-based communications strategies in their work for social change. The Institute publishes its research and recommendations, as well as toolkits and other products for the nonprofit sector, at www.frameworksinstitute.org.

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Endnotes

[1] A description of the research methods employed in this project can be found in the Appendix.

[2] Notes on terminology: As the best label for "someone who practices informatics" is a point of contention —some common options being *informatician*, *informaticist*, and *informatics specialist*—we use the term *informaticist* throughout this report, for consistency. The term *public health professional* refers to professionals across the field of public health, operating in many different contexts and roles, who might interact with informaticists.

[3] While experts often talked about public health informatics in the context of large-scale monitoring and surveillance, they emphasized that public health informatics and the closely related field of epidemiology are different. As one expert said, "Whereas epidemiology is about describing health in the fields, informatics is much more about systems."

[4] This is an essential aspect of interoperability, broadly construed, where *interoperability* is "the ability of different systems and software applications to communicate, exchange data, and use the information that has been exchanged." (HIMSS [2010]. Dictionary of Healthcare Information Technology Terms, Acronyms and Organizations, 2nd Edition) In addition, an expert noted that because electronic records are now a crucial part of health practice, public health informatics is even more important for communicating with clinical partners.

[5] These challenges do not represent a part of the expert story that would necessarily benefit from translation outside of the field; however, it provides useful background for the interviews to be conducted with health professionals.

[6] See Quinn, N. (Ed.). (2005). *Finding culture in talk: A collection of methods.* New York, NY: Palgrave Macmillan.

[7] For more on professional discourses, see Goodwin, C. (1994). Professional vision. *American Anthropologist*, 96(3), 606-633.

[8] Excerpts from interviews simply provide brief examples of how participants talked about topics—they have been edited for clarity and to remove any information that might identify the interviewee. See the Research Methods for a full description of how the analysis was conducted.

[9] This is not to suggest that other fields *are* fast moving compared to public health—rather that participants had this strong impression.

[10] A public health informatics expert drew an analogy between photography and informatics to describe the importance of the field: a camera is sophisticated technology, but crucially, a photographer creates the art. In public health professionals' interviews, the "photographer" was absent from their thinking, and there was no "art."

[11] As one reviewer astutely noted, participants might have been attempting to cite an example that the interviewer would find familiar. However, participants were very comfortable talking about the details of their specific work, using jargon and abbreviations as they did so, over the course of the interview. With this pattern in mind, we considered the example of EHRs to be the best (and sometimes the only) example that participants could access.

[12] Research by the FrameWorks Institute suggests that the best strategy for changing attitudes and engendering support for particular issues is improving understanding through framing. Key to this process is the introduction of values to the frame. Research has shown that, without an orienting value, people struggle to see the point of engaging with an issue in the first place.

[13] Explanatory Metaphors are frame elements that restructure the ways that people talk and reason about issues. These communications tools are useful in efforts to shift the interpretational frameworks that people access and employ in processing information.

[14] For more on Explanatory Chains, see Aubrun, A., & Grady, J. (2005). *Strengthening advocacy by explaining "causal sequences."* Washington, DC: FrameWorks Institute. Available at www.frameworksinstitute.org/ assets/Ciles/eZines/causal_sequences_ezine.pdf.

[15] McAdam, D. (1996). The framing function of movement tactics: Strategic dramaturgy in the American civil rights movement. In McAdam, D., McCarthy, J. D. & Zald, M. N., (Eds.), *Comparative Perspectives on Social Movements: Political Opportunities, Mobilizing Structures, and Cultural Framings,* 339-340. Cambridge, UK: Cambridge University Press.

[16] See for example: Rokeach, M. (1973). *The nature of human values.* New York, NY: Free Press; Shah, D., Domke, D., & Wackman, D. (2003). The effects of value framing on political judgment and reasoning. In S. Reese, O. Gandy, & A. Grant (Eds.), (2001) *Framing Public Life: Perspectives on Media and Our Understanding of the Social World*. (pp. 227-243). Mahwah, NJ: Lawrence Erlbaum.

[17] O'Neil, M., Kendall-Taylor, N. and Bales, S. N. (Eds.) (2015). Using frames to increase understanding and support for the social and behavioral sciences: A FrameWorks strategic messaging report. Unpublished manuscript.

[18] See, for example: Bales, S. N., & Gilliam, F. D. (2004). *Communications for social good*. The Foundation Center: Philadelphia, PA.