An informatics agenda for public health: summarized recommendations from the 2011 AMIA PHI Conference

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ABSTRACT

The AMIA Public Health Informatics 2011 Conference brought together members of the public health and health informatics communities to revisit the national agenda developed at the AMIA Spring Congress in 2001, assess the progress that has been made in the past decade, and develop recommendations to further guide the field. Participants met in five discussion tracks: technical framework; research and evaluation; ethics; education, professional training, and workforce development; and sustainability. Participants identified 62 recommendations, which clustered into three key themes related to the need to (1) enhance communication and information sharing within the public health informatics community, (2) improve the consistency of public health informatics through common public health terminologies, rigorous evaluation methodologies, and competency-based training, and (3) promote effective coordination and leadership that will champion and drive the field forward. The agenda and recommendations from the meeting will be disseminated and discussed throughout the public health and informatics communities. Both communities stand to gain much by working together to use these recommendations to further advance the application of information technology to improve health.

INTRODUCTION

In 2001, members of the public health and informatics communities gathered to develop a first-ever national agenda for public health informatics (PHI). Examination of needs within six tracks (1, funding and governance; 2, architecture and infrastructure; 3, standards and vocabulary; 4, research, evaluation, and best practices; 5, privacy, confidentiality, and security; 6, training and workforce) led to the development of 74 recommendations.[1 2] Two key themes emerged from those discussions: that all stakeholders need to be engaged in coordinated activities related to public health information architecture, standards, confidentiality, best practices, and research; and that informatics training is needed throughout the public health workforce.

On the 10-year anniversary of this landmark meeting which helped define the PHI field, the public health and health informatics communities again gathered to develop an updated national agenda for PHI, recognizing that, while much has been accomplished since the 2001 meeting, much remains to be done. Participants self-selected into one of five tracks: (1) technical framework; (2) research and evaluation;

(3) ethics; (4) education, professional training and workforce development; and (5) sustainability. Using a facilitated process, participants within each track reviewed progress that has been made on the specific recommendations from 2001 and determined what new recommendations were needed. Recommendations were collated across tracks to create an updated agenda, presented in box 1.

TECHNICAL FRAMEWORK

At the 2001 AMIA Spring Congress, two tracks—standards and vocabulary, and architecture and infrastructure—tackled the challenge of identifying gaps and recommendations for these foundational aspects of PHI.[1 2] Since then, access to computers in public health as well as a systems view of public health have become commonplace, driving demand for more sophisticated informatics tools. For AMIA PHI 2011, these tracks were intentionally merged. The scope of the technical framework track spanned the entire 'informatics stack': from data and vocabulary standards, conceptual models and technical architectures to back-end hardware and networking infrastructures; from domain-specific, middleware applications to population reporting, knowledge management, and decision support applications that feature effective user-centered design.

Technical framework track participants came from varied backgrounds and levels of technical expertise. They agreed that substantial advances have occurred in information technology (IT) and significant investments in public health information systems have been made at all levels. Looking forward, there was concern that the pace of informatics innovation has begun to tax and, facing chronic resource constraints, outstrip the ability of public health organizations to change and benefit from these developments. Legislation and regulation—such as the electronic health record 'Meaningful Use' Stage 1 objective requiring data transmission to public health organizations—will further stress the public health system even as it sets in motion future improvements. The technical framework track recommendations reflected four broad themes, focusing on strategic principles rather than tactical actions.

PUBLIC HEALTH VALUE CHAIN: SYSTEMS NOT SILOS

The public health value chain—operations, linked to practice, linked to assessment, linked to

improvement of programs and technology—applies to PHI. Track participants concurred that public health data and information systems that support the public health value chain will place a high priority on technical and semantic system interoperability. Technical architectures that do not support this value chain will have limited effectiveness and finite lifespans. Today, different technical approaches are being used across public health to solve similar problems, favoring short-term

Box 1 Recommendations developed at AMIA PHI 2011

Technical framework
T-1: Develop a comprehensive set of detailed public health business processes and use cases to guide PHI systems development and implementation toward semantic interoperability.
T-2: Promote development and use of effective user-centered design best practices in PHI system development.
T-3: Develop and support repositories of public health business processes, use cases, software applications, public health vocabularies and standards, data models, design concepts, software development lifecycle tools and implementation guides using an open-source community model.
T-4: Consider public health certification processes for (1) critical public health information systems and (2) electronic health record systems claiming public health interoperability to promote adherence to core public health data and messaging standards.
T-5: Develop model regulations that accommodate information exchange concepts to strengthen the privacy and security of public health information systems.
T-6: Significantly expand public health engagement in a complex set of data and vocabulary standards development, implementation, and maintenance activities.
T-7: Improve the consistency of federal public health architectures and data standards across health and public health agencies for promulgation to state and local health departments.
T-8: Significantly expand public health engagement in national interoperability initiatives to ensure that public health processes and functional requirements are appropriately represented and to support effective public health data exchange.
T-9: Provide data and vocabulary standards required for exchange of data between federal health and public health agencies through no-cost-to-US-end-user licenses for all US public health departments and agencies and related not-for-profit organizations.
T-10: Ensure that public health information systems developed using federal funding including modules developed on commercial proprietary software platforms are available for use by other public health agencies.
T-11: Develop and support a data standards lifecycle for all public health standards, including identification and support for ongoing standards maintenance.
T-12: Support dissemination of tools to local and state public health agencies that support mapping across varying standards and vocabularies.
T-13: Expand existing public health data models to encompass all public health business process and use case data elements (including, eg, environmental health data elements, restaurant inspections).
T-14: Publish an annual inventory/catalog of all public health-relevant data available through (1) existing publicly available databases and (2) in-production health information exchanges.
T-15: Improve the accessibility of public health data and information to all appropriate stakeholders at an appropriate level of complexity.
T-16: Promote widespread, effective, and responsible use of social networking and new media tools to achieve public health goals.

Research and evaluation
R-1: Convene a task force to continue development of a formalized PHI research and evaluation framework.
R-2: Align PHI research and evaluation priorities with identified public health problems and priorities.
R-3: Involve the PHI practice community in development of research agenda to ensure feasibility and successful adoption of recommendations.
R-4: Develop and evaluate new and existing applications of emerging techniques.
R-5: Develop environmental scan of existing sources of data.
R-6: Develop standards for scientific rigor similar to other sciences.
R-7: Foster research collaborations with other academic disciplines and private and public agencies.
R-8: Encourage PHI research and evaluation that draws from established theoretical or conceptual models.
R-9: Fully integrate PHI research and evaluation into public health curricula at graduate and undergraduate levels.
R-10: Develop continuing education programs for PHI research and evaluation.
R-11: Develop and implement relevant and innovative training methods and channels.
R-12: Encourage skills-based training in systematic PHI evaluation methods.
R-13: Identify academic competencies for PHI research and evaluation to supplement current PHI competency sets.
R-14: Influence the development of funding opportunities.
R-15: Create stable funding streams for PHI research and evaluation.
R-16: Require that 10% of funding for all public health systems support research and evaluation tied to a standard evaluation criterion.
R-17: Create policies and model agreements to facilitate electronic sharing of information.
R-18: Establish standards for PHI research and evaluation metadata, data access, and timeliness.
R-19: Clearly and concisely articulate value and needs of PHI research and evaluation to policymakers.

Box 1 Continued

Ethics

E-1: Support and foster a PHI ethics research agenda (addressing privacy, consent, disparity reduction, international development, etc).

E-2: Identify ethical, legal, and social issues in a manner that is explicit, structured, and comprehensive, particularly in the context of ARRA and HITECH.

E-3: Ensure that ethically optimized public policy demonstrates to stakeholders the utility and value of PHI.

E-4: Ensure that valid consent/assent processes improve understanding of benefits as well as risks of information technology in epidemiology and public health.

E-5: Discard, or refrain from use of, the term 'secondary use' as a misnomer in public health contexts—when data are collected for public health itself, their use is primary.

Education, professional training, and workforce development

P-1: Ensure PHI competencies remain current with changes in practice and technology.

P-2: Promote the further development of tiered PHI competencies.

P-3: Integrate PHI competencies into established public health competencies.

P-4: Continue efforts to establish PHI as a widely recognized and accepted discipline within public health.

P-5: Promote the use of standardized competencies and curricula in PHI-related post-secondary certificate and degree-granting programs.

P-6: Endorse a practice-based approach for PHI training.

P-7: Support training of researchers in PHI.

P-8: Develop a learning community in PHI to support public health professionals learning about informatics, healthcare professionals learning about PHI, and practicing public health informaticians.

P-9: Create a standardized and recognized job title and description for PHI jobs.

P-10: Establish a credentialing system for public health informaticians.

P-11: Develop subspecialties within PHI as the profession evolves.

P-12: Develop and implement a marketing and promotion initiative for PHI and informaticians.

P-13: Encourage public health funding agencies and foundations to require the inclusion of a qualified public health informatician on contracts, grants and cooperative agreements that collect, manipulate, and disseminate data and information.

P-14: Develop and deploy measures and metrics to evaluate the impact of PHI training and education on public health program and health outcomes.

P-15: Support global PHI training and education in middle- and low-resource countries.

Sustainability

S-1: Develop a national process and entity for governance of public health infrastructure investment.

S-2: Assign a tiger team, develop a draft project charter, and designate a coordinating agency for developing a strategic plan for governance of public health infrastructure and informatics investment.

S-3: Recruit representatives from national entities (government agencies, scientific and professional associations, non-governmental organizations, corporations, etc) to develop the strategic plan for PHI governance.

S-4: Develop the plan to include a portfolio of success stories, use cases, model governance documents and structures, and incorporating PHI in public health accreditation.

S-5: Present the plan and engage in a national campaign to achieve sustainable public health infrastructure and informatics investments.

S-6: Pursue creative funding models to include transformation of traditional models and aggressively pursuing partners for non-traditional funding models.

S-7: Reassess and transform public health culture and perception from a federation of categorical programs (and associated funding streams) into an enterprise with capacities/capabilities providing services to the community. Socialize and 'sell' the services, benefits, and cost savings of the public health enterprise using a portfolio of success stories.

solutions to local needs over long-term support for public health architectures. This technical diversity is not always cost effective, nor is it always necessary. More evaluation is needed to determine the informatics interventions that yield highest value for public health.

ARTICULATE PUBLIC HEALTH BUSINESS PROCESSES AND USE CASES

The public health value chain is composed of business processes and use cases that describe the flow of data and information. Business processes describe how data, information, and knowledge are used by creating a framework that relates work activities to domains of public health function. Use cases describe how end users interact with PHI systems, data, and

information. There is a need to better articulate and describe the common, complex processes and use cases that extend across public health practice, as their absence makes automation challenging and often inefficient. There are domestic and international efforts that are working toward this goal. The Public Health Data Standards Consortium, Public Health Informatics Institute, and the Council of State and Territorial Epidemiologists have been working in parallel and in collaboration with Federal efforts such as the Healthcare Information Technology Standards Panel and the US Federal Health Architecture.[3] Internationally, the International Society for Disease Surveillance, the WHO,[4] and the International Standards Organization,[5] among others,[6] have made important contributions.

The full breadth and diversity of public health has yet to be fully described through a single overarching information domain model. However, future improvement in PHI requires the public health and informatics communities to continue to work together to better articulate core business processes and use cases that would act as an implementation guide for PHI systems development, with sufficient flexibility to allow for organizational needs and variability.

BROADEN ACCESS TO PHI TOOLS, DATA, AND INFORMATION

Robust data and information sharing is necessary to ensure that all levels and participants can adequately access needed tools, data, and information supported by effective user-centered design. Successful PHI activities need to be able to leverage existing data collection and information dissemination activities that occur within the personal healthcare delivery system in order to reduce duplication of effort and to enhance data acquisition integrity. Participants proposed an annual inventory/catalog of all public health-relevant data available through existing publicly available databases and in-production health information exchanges.

Expanding the development and dissemination of public health data standards and vocabulary tools (business processes and use cases; software applications, data models, design concepts, software development lifecycle tools, and implementation guides, using an open-source community model) is critical to improving access. Dissemination and training must be improved; many participants were unaware of freely available National Library of Medicine terminologies and vocabulary tools, such as the Newborn Screening Coding and Terminology Guide, and the Centers for Disease Control and Prevention's Public Health Information Network Vocabulary Access and Distribution System.

SUSTAINABLE TECHNICAL FRAMEWORK

For a public health IT intervention to be successful, its technical framework should support semantic interoperability and data reuse. Interoperability requires implementation and consistent use of standards for data and coding to improve the quality and value of data available for all core public health goals and essential services. Participants noted that public health professional associations, cross-organizational groups such as the Joint Public Health Informatics Taskforce, and local, state, and federal agencies must significantly expand their engagement in standards creation activity. Strong information security standards, policies, and enforcement that specifically allow innovations such as health information exchanges will also be critical in maintaining the public's trust.

Future public health information systems should learn from past implementation experiences, which are openly discussed and published so that lessons learned may be effectively promulgated across public health. Future systems will also adopt innovative technologies, such as cloud storage, grid computing, social networking, and mHealth. Formal certification of systems may be necessary to maximize semantic interoperability with non-public health source systems, such as electronic health records. However, it will be important that innovation is not stifled through narrowly scoped certification processes.

RESEARCH AND EVALUATION

The goal of the research and evaluation track was to develop recommendations to foster leading-edge PHI research and evaluation in both academic and practice settings. Track participants considered research and evaluation for improving information access, communications, workforce development, standards and interoperability, and best practices. Each of the four breakout sessions was dedicated to a specific topic: (1) an overview of the past 10 years; (2) methods; (3) training and collaboration; (4) future directions. Overlapping themes occurred across sessions, so a faceted domain approach was employed to analyze and report the discussion content. Four domains of PHI research and evaluation were identified: practice, training, funding, and policy. Each domain was categorized using three facets: key considerations; opportunities and challenges; and recommendations.

Practice

A key consideration included identifying PHI study questions that relate to public health practice. Recognition that public health data are not limited to human illness, but include animal, insect, and environmental data was noted. These pose special challenges for PHI research and evaluation because of their unfamiliarity and difficult access. Public health practitioners and researchers demand increasing access to accurate, complete real-time data, as well as data from sources such as the police and schools. Technology has broadened user populations and expanded geographical and professional boundaries, presenting challenges for quality and knowledge discovery. Finally, researchers and evaluators need to understand the information focus of public health vis-à-vis PHI, wherein the former addresses health-related behaviors while the latter addresses information-related behavior.

There is a continued need for standardized evaluation tools, metrics, and theoretical frameworks germane to PHI. Priorities have changed from a post-9/11 preparedness focus to a focus on electronic health records, health information exchanges, and meaningful use. A shifting paradigm exists in terms of data and data streams, offering new opportunities for developing methods for sharing and managing data. The ability to rapidly and seamlessly share data necessitates development of security and privacy policies that both ensure the public's trust and avoid impediments to PHI research.

Several of the specific practice domain recommendations demand emphasis. First, we recommend that a formal task force be convened to develop a framework for PHI research and evaluation. This task force should involve members of the informatics and public health practice community to ensure that the needs and capacities of both are addressed. Second, an environmental scan is needed to identify and catalog useful data sources. Finally, PHI shares much of its scientific methodology with the social sciences, and will benefit from increased understanding and use of social science theoretical models and frameworks.

Training

The increased availability of public health-related datasets carries an obligation to provide training in new methods for data acquisition and analysis, integration of large, complex data into decision making, and a focus on solutions rather than technologies. There are notable opportunities for PHI research and evaluation training through the HITECH Act and emerging Beacon Communities. These training opportunities, including on-the-job and certificate programs, require maintenance and oversight. Finally, with the increasing specialization of the public health workforce, training programs should address integration of PHI into all aspects of public health.

Funding

While research opportunities continue to increase, available funds are decreasing. Multiple funding sources are often needed for a single project, yet funding opportunities are increasingly episodic. Another challenge is the mismatch between the typical 2–5-year grant cycle and the need for long-term population-based follow-up. The PHI community should actively participate in the shaping of state and national funding priorities. Funders and legislators must be made aware of the key role that PHI research and evaluation plays in maintaining and improving the public's health. A specific recommendation is that all PHI-related projects include 10% of the overall budget for research and evaluation, with continued funding tied to specific evaluation criteria.

Policy

Although open, publicly available data are deidentified, they still represent a theoretical risk of disclosure. The public health community and the public are increasingly aware that health data represent a valuable resource for monitoring and maintaining the public's health. However, strong data privacy, security, stewardship, and access policies, as well as modern data use agreements, are central to ensuring public trust. Track participants felt strongly that policymakers were largely unaware of PHI, especially with regard to research and evaluation, and that improving awareness by articulating the value of PHI research and evaluation to legislators, funders, colleagues, and the public is critical to the PHI mission. Data use agreements regarding appropriate access, record linkage, and transfer to third parties should be updated continuously to reflect current laws and policies, making it essential that PHI data are described with rigorous metadata.

ETHICS

The presence of an ethics track constitutes important recognition of both the importance of ethics in PHI and a decade of only modest success in incorporating attention to ethics into PHI.

The ethics track was an opportunity for the community to identify issues, explore agenda-setting opportunities, and learn from initial attempts to explore ethical issues raised by PHI.[7] The track was a forum to assess progress since 2001, including advice to: (1) create a national forum on privacy with special regard to electronic data collection and use in epidemiology and public health; (2) consider creation of public health ethics committees analogous to hospital clinical ethics committees; and (3) consider establishing a formal ethical, legal, and social issues program for PHI.[1 2]

The first recommendation was focused, but not apparently pursued, as it was not entirely clear to whom these recommendations were directed. Given this, framers of the PHI ethics track sought to identify an ensemble of issues (grouped into four headings) to guide discussions, increase the precision of any resulting recommendations, and guide future research.

IT for research and surveillance

This broad area assesses the scope and applicability of informed or valid consent when IT is used in public health and epidemiology. It subsumes the following topics or questions: the distinction between research and surveillance as applied to IT; the role of information and communication technology; the role of and need for valid consent for data acquisition; the tensions that arise at the intersection of valid consent and privacy; the disclosure of risks of data collection and analysis; challenges for marginalized and traditionally under-represented populations;

the concept of 'group (or community) consent'; and special challenges related to the use of public health information in emergency situations.

Decision support systems in epidemiology and public health

Although the literature on ethical issues related to the use of decision support systems is well established, questions of appropriate uses for population health remain under-addressed. Agenda-guiding questions included the following. Are clinical decision support systems a good analogy or precedent for public health systems? What lessons can be applied in PHI? What are optimal strategies for managing uncertainty and probabilistic data? How should risk be communicated? Who are the stakeholders at the complicated interface of software engineering, public health, and ethics?

Registries, repositories, and databases

The accomplishments of population health science were once beyond controversy. An agenda has recently emerged that seeks to roll back, or impede, decades of public health success, often using the language of privacy and ethics to misdirect or confuse the true issues. Some argue that individual consent is necessary for submission of data to public health registries, biologic specimen repositories, and population databases used for public health surveillance and analysis, even if anonymized. There is some evidence, however, that ordinary people not only support the use of their information for this purpose, they also presume it is already occurring for their benefit and that of their communities.[8] Digital information collection and storage does raise legitimate ethical issues and it could be argued that these issues are part of the scope of PHI.

International issues

International health disparities might constitute one of the most important ethical issues and challenges faced by policymakers. Whether improved PHI tools will reduce disparities remains an empirical question, but some data suggest that more and better data will improve health in the resource-poor regions. Are there duties to use and make available health IT and information and communication technology tools in developing countries? What social and cultural differences arise, and how ought they be addressed? Are ethical, legal, and social issues different in the developing world?

Recommendations

A set of focused recommendations emerged from the ethics track. It remains for government and regulatory bodies to embrace them, by supporting a non-partisan research program and infrastructure, and for academic institutions to incorporate (a) PHI into existing ethics and informatics curricula and (b) ethics and PHI into existing public health courses.

EDUCATION, PROFESSIONAL TRAINING, AND WORKFORCE DEVELOPMENT

With the continuous rapid rise of electronic storage, access, and exchange of public health information, there is an urgent need for trained professionals who can effectively manage these data and information systems. Since 2001, numerous programs offering degrees and certificates in PHI have been established, and PHI competencies have been developed and vetted.[9 10] Even with these major accomplishments, there remains a need to build public health workforce capacity in informatics.

PHI competencies

Ensuring that PHI competencies remain current is vital. Participants recommended examining activities, such as electronic guideline dissemination, electronic laboratory result reporting, preventable disease efforts, support of accountable care organizations, maintenance of immunization registries and emergency preparedness and response, to determine possible needed competencies. Although covered in the 2009 PHI competencies,[9] the participants discussed the need to emphasize competence in systems thinking, evaluation, and transdisciplinary approaches to problem solving, communication, leadership, advocacy, and technology.

Participants recommended that existing competency work[9][10] should be foundational to 5-year review of roles and responsibilities of practicing public health informaticians, at entry, supervisory, and senior levels. Additionally, these competencies need to be integrated into public health. A collaborative effort between the AMIA Public Health Informatics Working Group, Association of Schools of Public Health, American Public Health Association, and other stakeholders to incorporate PHI as a discipline within public health would promote this integration.

PHI curricula

PHI must be recognized as a profession, and the education and training programs to cultivate professionalization must be supported. Post-secondary certification programs through doctoral programs with curricula based on recognized PHI competencies are necessary to establishing consistency in their graduates. This standardized curriculum is critical to allow better understanding of the potential employees' PHI capabilities. Practice-based approaches for training, such as best practices, use case scenarios, and applied case studies, must be developed and widely disseminated. The participants recommended that funding should be made available to support fellowship and graduate programs.

Global PHI training

Globally, outreach activities should be undertaken to support PHI training in middle- and low-resource countries. In-country partners should be identified to build a sustainable training network. Sharing of materials and curricula should be encouraged. Global informatics activities by groups such as the WHO, AMIA Global Health Informatics Partners, and Health Unbound should be leveraged.

Development of the public health workforce

All levels of the public health workforce must be trained in PHI principles, concepts, and methods. This training should be tailored to the public health professional's level of responsibility and role. Incentives should be offered to support informatics continuing education programs, such as inexpensive and readily available courses. Participants discussed the development of continuing education through a Webinar format, with a series of interactive, applied training use cases and a forum for sharing knowledge. Utilizing ongoing PHI activities of the Association of State and Territorial Health Officials and the National Association of County and City Health Officials to promote knowledge exchanges must also be supported. Failure to educate the professional public health workforce in PHI will multiply poor judgments about systems investments, creating inadequate and untimely data for decision making.

PHI careers

The lack of job descriptions and an ambiguous definition of PHI have hindered the development of a defined career progression. Specified informatics competencies appropriate for different career levels, designated job classifications, and identified and recognized subspecialties in the domain are essential to career development.

Professionalization of the PHI workforce

There was strong consensus that the future for the PHI workforce must include professional credentialing. Motivating individuals to become credentialed and maintain the credential and for employers to demand credentials in prospective employees is challenging. Developing evidence that PHI credentialed employees affect the improvement of public health programs and health outcomes will strengthen the demand. Federal granting agencies (CDC, HRSA, NIH, AHRQ, etc) and other funding sources must include in their grant guidance requirements that staff overseeing new information system projects be certified in PHI. To facilitate professionalization, participants recommended, in the short term, development of advocacy campaigns and a basic informatics primer to inform senior leaders in public health of the value of informatics. In the midterm, standardized PHI job descriptions should be developed and disseminated, and, in the long term, an independent taskforce should be created to explore the merit and development of professional certification.

SUSTAINABILITY

Public health activity achieves a state of sustainability when prioritized and supported over the long term based on delivery of measurable, quantifiable, beneficial, clinical, economic, or social outcomes. The sustainability of PHI is tied largely to its value as a strategic contributor to this process. The 2011 sustainability recommendations reflect lessons learned and the need for action on the 2001 recommendations.

How far have we come since 2001? Where do we need to go? How do we get there?

The foundational papers by Yasnoff *et al* in 2001 articulated 11 recommendations, which included funding and governance.[1][2] The recommendations from 2001 map to sustainability and fall into several general areas: leadership; planning, inclusion, and governance within the broader context of the healthcare continuum; establishing the business case for investment, focusing on clinical priorities and information, not technology; identifying sustainable funding sources across the healthcare continuum; and evaluation.

In 2007, an editorial by Kukafka and Yasnoff assessed the progress toward achieving the vision articulated in 2001.[11] They noted that, while there were large-scale focused investments in single-purpose categorical syndromic surveillance programs, large-scale challenges in preventable disease also emerged. The authors concluded: 'We believe that a narrowly focused view of public health, and by extension PHI, exposes the field to potentially negative outcomes (going to the core of sustainability)'. They recommended:

▶ *A broader perspective*: Informaticians must develop broader perspectives on what constitutes public health and, by extension, what constitutes PHI.

▶ *Strengthening prevention in the public health/clinical continuum*: PHI can refocus to embrace its role as strategic partner in leveraging and reusing information and information

infrastructure to support and enable effective public health practice.

▶ *Building health at the community level*: PHI can build on its community coalitions' history to enable and optimize building and strengthening community networks.

The convergence of healthcare reform, fiscal crisis, and government downsizing presents daunting challenges to the support of sustainable public health practice, programs, research, and learning. Categorical public health program culture and funding and public perception must change at a fundamental level if we are to meet these challenges over the next decade. Public health practice must become, and be perceived as, an enterprise that is part of the continuum of healthcare, with strategic program goals aligned with strategic PHI investment priorities.

Recommendations

Reassess and transform public health 'culture' and perception
Public health 'culture' must be transformed from a loosely held federation of categorical programs (and funding streams) into an enterprise that provides a continuum of community services, from preventing or intervening in disease outbreaks to producing healthy babies. A portfolio of public health success stories can socialize and promote the services, benefits, and cost savings with the community and strategic partners.

Develop a national body and process for governance of public health and PHI investment priorities
The body should have direct impact on funding, reinforced by accreditation. The process would identify a portfolio of clear, focused, strategic priorities for the public health enterprise, which would be validated against feasibility, cost, risk, value, success case studies, impact, and 'health' return on investment. The portfolio would drive investment. The governance body would articulate, promote, and socialize the strategic vision, priorities, public and private partnerships, and investment strategies across the health enterprise. The governance body would develop and promulgate business cases and evaluation processes and metrics to ensure that investments meet the strategic objectives. A bottom-up approach should be undertaken to translate national strategic agenda, projects, and investment strategies into tactical frameworks for state and local implementation.

Identify strategic partners
As part of the continuum of healthcare enterprise, public health will need to identify and engage non-traditional partners, such as federal agencies—CMS, AHRQ, FDA, and USDA. Subject matter experts in related business and informatics disciplines can provide insight and assistance in developing a sustainable public health business model. Other key partners include private payers, ACOs, and Beacon Communities.

Develop and adopt creative funding models
Categorical funding guidance needs to evolve funding to an integrated information architecture that yields systems more able to support an array of public health business functions with more robust information architecture. Strategic partners and subject matter experts could work to develop reimbursement strategies and business partnerships less reliant on federal categorical grants or state/local government funding streams. Creative funding might include: identification of venues where public health is reimbursed for services provided to the public, per capita or outcome-based performance measures; or

serving clinical or payer organizations to provide population health subject matter expertise or population health analytic services.

Public health should function more like a business enterprise and articulate the beneficial outcomes to both the community and its strategic business partners. In this context, the challenge and opportunity for PHI in the next decade is to recast itself in the role as a strategic partner for public health, a partner whose contributions are transformative, applying innovative approaches in IT and information science to building public health capital within the community of care.

KEY THEMES
Close review of the AMIA PHI2011 recommendations reveals three key themes that cross all five tracks.

First, we need to *enhance communication and information sharing within the PHI community.* Information science advances and decreasing IT costs have changed the collection, analysis, and dissemination of data and information. The paradigm is shifting to real-time availability, with effective user-centered design practices expanding the user base from a handful of skilled knowledge workers to entire population subsets. During the past decade, a substantial investment has occurred in the development and implementation of personal health and public health information systems, notably the large infusions of post-9/11 and ARRA funding. A wealth of collective experience is embedded within these endeavors, but very little of this experiential capital is shared widely within the PHI community. The robust, freely available terminology resources of the National Library of Medicine are not well understood outside academic and federal agency levels. Across the focus area tracks, it was evident that attention must be focused on activities that bridge this information gap, such as the development and maintenance of a comprehensive inventory of available public health data sources at a granular level of detail.

Second, we need to *improve the consistency of PHI through common public health terminologies, rigorous evaluation methodologies, and competency-based training*; this is essential to leveraging future PHI investments. Public health is becoming increasingly dependent on the electronic collection of data. In an era of fiscal restraint, effective data stewardship will be necessary to maximize what and how data are collected. Understanding the core business processes and use cases that describe the entirety of public health practice and ensuring that future systems are developed with these in mind will be critical to increasing data yield. Similarly, data and vocabulary standards germane to public health should be widely adopted across the enterprise and should exist within a well-defined data standards lifecycle that includes development for domains that do not currently have appropriate standards. Central to improving the effectiveness of PHI activities is the need to elevate the level of research and evaluation activities. Formal evaluation methods for PHI that are informed by collaborations with other fields and disciplines should see widespread adoption and use. Rigorous evaluation can help to determine the comparative effectiveness of multiple informatics solutions that solve a single public health practice problem. Achieving the balance between innovation and evidence-based practice will require PHI competencies that are promulgated and adopted by all levels of academic training programs and workforce development initiatives. These competencies must be periodically reviewed and actively managed, changing to accommodate new developments in practice and technology. When paired with enhanced communication and information-sharing activities, it will be possible to

develop learning communities in PHI to support all public health professionals.

Third, and most critically, we need more *effective coordination and leadership that will champion and drive the field forward*. In 2001, the need for 'coherent governance' to provide coordination over disconnected PHI activities was a key theme.[1] Specific recommendations were made as to how this might be accomplished, but these recommendations were among those that were not implemented. PHI is an integral part of the public health enterprise, and the current and future investment in the PHI infrastructure is substantial. A plan for PHI governance is needed, with a coordinating agency designated to organize the effort along with the Joint Public Health Informatics Task Force. Organized national leadership should exist to serve as champion, convener, monitor, and facilitator for PHI as a whole. Leadership is also needed to advocate and align research and evaluation priorities with public health problems and priorities, to address the subtly nuanced areas of privacy and ethics, and to maintain competencies and further establish PHI as a discipline within public health.

CONCLUSIONS

The AMIA PHI 2011 Conference successfully brought together members of the public health and health informatics communities to revisit the national agenda first developed at the 2001 AMIA Spring Congress. The past decade has been a period of unprecedented growth and interest in health informatics; PHI has also evolved and been active at all levels of government. Of the recommendations from 2001, many were found to have already been implemented; others were found to be no longer relevant. Discussion tracks at AMIA PHI 2011 focused on: technical framework; research and evaluation; ethics; education, professional training, and workforce development; and sustainability. Participants identified 62 recommendations, which clustered into three key themes related to the need to: (1) enhance communication and information sharing within the PHI community, (2) improve the consistency of PHI through common public health terminologies, rigorous evaluation methodologies, and competency-based training, and (3) promote effective coordination and leadership that will champion and drive the field forward.

While there was general consensus on many issues, considerable work remains to be carried out to clarify the most difficult and challenging problems. These recommendations will be disseminated and discussed throughout the public health and informatics communities. As in 2001, both communities stand to gain much by working together to use these recommendations to further advance the application of IT to improve health.

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