Systematic Collaborative Approach to Improve Public Health Programs

Leveraging Immunization Registration Example

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Mandatory disclaimer

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Summary

Background: Public health programs can benefit from systematic collaborative approaches that use business analysis and structured facilitation techniques to effectively address strategic and operational challenges.

Objectives: To provide practical guidance for senior public health leaders and program managers on how to apply systematic analysis, facilitated collaboration, and consensus building to rigorously document, analyze and improve programmatic operations.

Methods: Analysis models provided a systematic way to assess and capture business needs and institutional knowledge. These models supported three stages of collaborative work: discovery, where the stakeholders document understandings of how the current program operations work, assessment of what is working well and what isn't, and specification of agreed-upon program requirements. Facilitated collaboration and consensus-building techniques supported the analysis process.

Results: Our experience over the past ten years in the area of Immunization Information Systems (IIS, formerly known as Immunization Registries) indicates that collaboration among stakeholders and systematic analysis promote system thinking and improves public health operations. Application of approaches described in this paper to the IIS domain of federal agencies, state and local health departments resulted in improved data quality, reduced IIS staff time, and increased efficiencies across IIS programs.

Conclusions: Public health leaders can use systematic collaborative approaches, such as those used in the IIS (i.e., immunization registration) domain, as an effective instrument to address strategic and everyday operational challenges in other areas of public health. Shared solutions to common problems, preservation of institutional knowledge, quality improvement, and cost savings are all benefits that can be expected.

Keywords: Immunization Information System, Registries, Consensus Workshops, Group Processes

Introduction

The public health enterprise can benefit in bringing more systematic, collaborative, and rigorous approaches to solving shared challenges. In this paper, we propose that public health leaders can use proven systematic collaborative approaches, such as business analysis, structured facilitation, and consensus-building used in the immunization domain, as an effective instrument to address strategic and everyday operational challenges in other areas of public health.

Improving performance, or improving how information technology supports programmatic goals and activities, first requires having a clear understanding of what those activities are and why they are performed in the ways that they are. Many industries, both public and private, including health care and manufacturing, carefully analyze workflows to ensure organizational goals and operational needs are met, and are properly reflected in any information technology (IT) requirements. The President's Council of Advisors on Science and Technology recommends [1] systems engineering and information science approaches, along with partners' collaboration, as key factors for health-care advancements.

For the last ten years we applied systematic analysis methods to the domain of Immunization Information Systems (IIS, also known as immunization registries)[1] in order to better formulate programmatic goals, the operational processes needed to meet those goals, and, eventually, the IIS application requirements to effectively support those processes. Collaboration of IIS managers from state and local health departments, programmatic staff, health care providers, public health consultants, interoperability experts, and academicians resulted in a hierarchical framework of standards and guidelines that reflect consensus-based common recommendations and solutions. Independent evaluation [3] of our efforts indicate that application of approaches described in this paper to the IIS domain resulted in improved data quality, reduced IIS staff time, and increased efficiencies across IIS programs. We propose that application of these methods can benefit other areas of public health.

Methods

Systematic analysis [4, 5], supported by facilitated collaboration [6] and consensus-building methods [7, 8], has been used to formulate requirements for, improve the performance of, and document institutional knowledge about key functional aspects of public health programs. Figure 1 illustrates how combining the approaches of systematic analysis with facilitated collaboration and consensus building within a public health program domain resulted in a detailed model of the program's operations and processes. The model includes details on the *why* (goals), *who* (people, systems, organizations), *how* (activities, rules), *where* (locations), *what* (concepts, terms, facts), and *when* (time, frequency) for that program domain, ensuring a shared, consensus view of how that program would optimally operate; in other words, the model details the components of a promising or best practice.

[1] Immunization information systems (IIS) are confidential, population-based, computerized databases that record all immunization doses administered by participating providers to persons residing within a given geopolitical area [2].

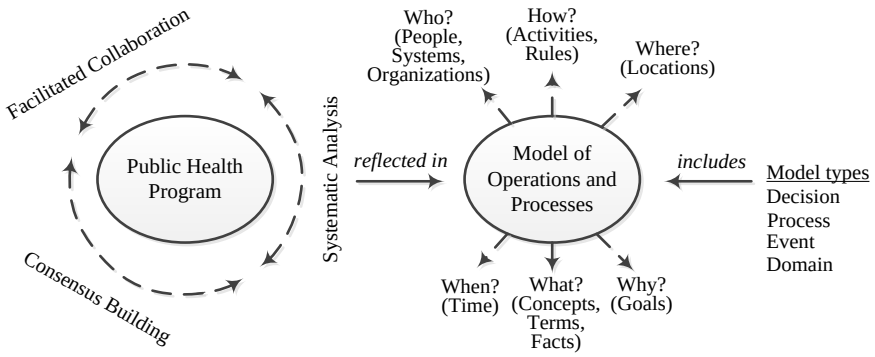

Figure 1. Systematic collaborative consensus-building approach to analyze and model public health programs.

Breaking a typically complex public health program into its component parts (i.e., why, who, how, where, what, when – as explained above) makes it easier to both understand the program (from its policies to technical implementations) and to explore how its parts work together (or don't) to create an efficient whole. Such analysis models support three stages of collaborative work: discovery (where the stakeholders document understandings of how exactly the current program operations work, which sometimes isn't clear to everyone, in all areas of operations), assessment (i.e., what is working well and what isn't, as well as discussions of improvement options), and specification (i.e., agreed-upon program requirements that should be implemented). Analysis models provide for a systematic way to assess and capture business needs and institutional knowledge that would likely otherwise be buried in thick manuals, software code, and people's minds. Ultimately these models[2] enable smarter design of information technologies to support inter-related program components.

To accurately capture program complexities and inter-dependencies, all relevant stakeholders need to be involved in the analysis process. For example, for our work with the IIS community that has been conducted since 2005, those stakeholders included IIS managers, programmatic staff (e.g., provider recruiters and trainers), health care providers, public health consultants, interoperability experts, and academicians. Over the years, representatives from 28 state health departments participated in these efforts. Collaboration activities were facilitated among the large groups of experts, small sub-groups, and individual contributors. Facilitated collaboration is most efficient in the in-person settings. However, since stakeholders were dispersed across the country, in-person analysis meetings were combined with virtual (teleconference) sessions in order to reduce costs.

[2] In various projects over the past ten years, we have applied domain modeling in a variety of public health areas, providing a common vocabulary and establishing a foundation for other model types (see the far right of Figure 1): (a) decision models, such as business rules [9] and decision tables, to unambiguously document high-level policies, institutional knowledge, and operational-level decision-making; (b) process models, such as use cases (structured description of operational scenarios) and a variety of process diagrams, to describe processes and process participants; and (c) event models to analyze events that lead to change of statuses for various public health concepts (e.g., status of a vaccine dose during its life cycle).

Results

We used these systematic methods for over a decade with the IIS [2] community. Because immunization information exchange is at the heart of IIS operations, IIS have developed sophisticated interoperability specifications, intricate data quality rules, and complex record merging and matching (deduplication) rules.

Table 1 illustrates four levels of collaboratively developed guidance for IIS, each characterized by a unique but highly interdependent purpose: (1) to define programs goals and standards; (2) to analyze high-level business processes; (3) to detail operational guidelines; and finally, (4) to design technology specifications for a particular IIS application. At each level, stakeholders were actively engaged, using methods of business analysis, facilitated collaboration, and consensus building to scrutinize current practices and problems and to document prescribed solutions in the form of guidelines. Each level is interdependent with the others.

Level 1 – Programmatic goals and standards. At the highest level (Table 1, Level 1), IIS Functional Standards [10] were collaboratively developed to establish overall programmatic goals, each with corresponding IIS functional requirements. Examples of programmatic goals include supporting the delivery of clinical immunization services at the point of immunization administration, regardless of setting and supporting the activities and requirements for publicly-purchased vaccine. The purpose of the standards was to establish programmatic performance measurements for the IIS community as part of federal funding to local and state IIS programs. The standards also help guide overall program policy, strategy and planning, and establish an expectation of continually improving performance over time. An important aspect of this work was that it was a collaboration of funders and funding recipients, of those measuring performance and those accountable for their performance. Developing such standards through a collaborative process ensures appropriate stakeholder engagement and buy-in, making sure that everyone has the same expectations going forward, as well as minimizing obstacles to progress that can occur when parties disagree on overall vision, direction and metrics. The same benefits of collaboration apply to the remaining levels below.

Level 2 – Business processes. To provide more specificity and completeness in documenting IIS operations, a year-long collaborative project of local, state and federal stakeholders was undertaken to develop extensive documentation of IIS business processes and related functional requirements [11] (Table 1, Level 2). Examples of business processes include facility/organization registration, patent reminder/recall, creating a record on a newborn, patient deduplication, vaccine deduplication, vaccine inventory management, and user report generation. Organizing around key business processes provided a more detailed picture of IIS operations, in part to ensure the information system supports the metrics that have already been established at Level 1.

Table 1. Four levels of analysis and modeling in the IIS domain

	Description	Typical Use	IIS Reference	Sample Content/Uses
Level 1	Official **programmatic goals and/or standards**; highest level of operational requirements	To guide program policy, strategy and planning *Answers the question: What does my program need to do and achieve?*	IIS Functional Standards, 2013-2017 [10] Immunization Program Operations Manual [18]	*Example of IIS programmatic goals:* • Support the delivery of clinical immunization services at the point of immunization administration, regardless of setting. • Support the activities and requirements for publicly-purchased vaccine.
Level 2	High level, broad description of **business processes** in a public health program; technology neutral	To identify, document and improve process/workflow and associated system functionality *Answers the questions: What are the recommended workflows for staff to follow? What does the IT system have to do to support those workflows*	Functional requirements for IIS [21]	*Example of IIS business processes:* • Facility/organization registration • Query/add/edit patient record • Manage inventory • Patient reminder/recall
Level 3	Detailed, in-depth **operational and best practices guidelines**; technology neutral	To improve programs' operations and systems functionality by meeting common best practice guidelines *Answers the question: What are best practices to achieve effective and efficient results?*	MIROW best practice guides for IIS [14] Clinical Decision Support for Immunizations [19]	*Example of MIROW guides:* • Data Quality Assurance • Reminder/Recall • Management of patient active/inactive status
Level 4	Detailed design and implementation **specifications** for a particular program/system/ environment; technology-specific	To support local system development/ procurement, for design specifications and requests for bids/proposals *Answers the questions: What are the specific requirements of our program and our organization's IT environment?*	Individual state RFPs; sharable technology solutions	Generally jurisdiction specific, but could include specifications for a software module or tool, or an open source solution, used by multiple agencies.

Level 3 – Operational/best practice guidelines. At an even more detailed operational requirements level (Table 1, Level 3), multi-year, ongoing collaborative efforts of the American Immunization Registry Association (AIRA) [12] and the Immunization Information Systems Support Branch at Centers for Disease Control and Prevention (CDC) [13] resulted in a series of consensus-based best practice guides [14,15]. The purpose of these guides is to help ensure consistent operational practices among IIS [15]. Detailed operational guidelines were developed for several key functional areas of IIS, including data quality assurance, vaccine inventory management, management of patient eligibility for publicly-funded vaccines, reminder/recall, vaccination level deduplication, management of patient active/inactive status, and adverse events reporting. Each of these complex functional areas must be operationalized by IIS programs across the country in state and local health departments, such as in Kansas [16] and Washington [17]. The guides provide strategies on how to address problems, issues, and barriers, a variety of specific business rules and general recommendations to apply to program operations, recommended reports, illustrative examples and templates, and a set of agreed upon terms and definitions. The benefits [3, 15] of this consistency are in increased efficiencies, a more standardized level of operational quality, and improved data validity for regional and national analyses. By working together to define best practices, significant effort can be saved across the community, and greater process standardization and more consistent operational performance achieved. Even though these guides are very detailed, they remain at the operational level and are independent of any particular IIS application or IT environment.

Level 4 – System specifications. Finally, Level 4 is the most granular and specific level of analysis. For instance, Level 4 is where we would find an agency-specific request for vendor proposals to develop or enhance an application for use by that agency. Historically, detailed software specifications would be unique to an agency, since they would be based on the particular software tools and IT operating environment unique to that agency. More recently, cloud computing and other innovations have enabled development and use of shared solutions across multiple jurisdictions, so that even Level 4 specifications can be collaboratively developed and implemented by a broad range of stakeholders.

For a new public health program, guidelines should be developed in a sequential manner, starting from the Level 1 to develop programmatic goals and standards first. After that, referencing level 1 guidance, guidelines for levels 2 and 3 – business processes and operational guidelines – may be produced. These documents would provide a basis for the level 4 activities in creating implementation-level specifications. In our case, for the IIS (i.e., immunization registration) domain, federal and state programs were already in-place and operational for a long time. Therefore, extra efforts had to be spent for coordinating out-of-sequence efforts to update existing and develop missing guidelines for all hierarchical levels.

Discussion

Systematic analysis of operations and processes

While public health has a rich history in the application of formal scientific and statistical methods for policy and operational decision-making, the same level of rigor has not been applied to the systematic analysis of operations and processes; i.e., the day-to-day activities of public health programs. Application of such methods helped to develop guidelines for public health programs and requirements for the information systems that must support them—leading to improved programmatic performance and documented institutional knowledge that can be preserved and shared.

Systematic collaborative analysis is a proven approach

Our experience indicates that systematic collaborative analysis of program operations promotes systems thinking and helps scrutinize and improve public health operations and processes. Independent evaluation findings [3] indicate that application of these methods in the IIS domain of state and local health departments resulted in improved data quality, reduced IIS staff time, and

increased efficiencies across IIS programs. It also helps break otherwise complex programmatic and operational challenges into manageable fragments which can be incrementally improved upon. The collaborative nature of the approach ensures participation of stakeholders and, as a result, acceptance of developed guidelines and other work products by the public health community.

Programs' need drive their IT systems development
Developing overall programmatic and information system maturity is built on fundamental paradigms such as "design before construct" and "public health needs should drive information technology solutions (not the other way around)." As IT services and staff become increasingly centralized and less likely to be imbedded with public health program staff, it is all the more critical that program staff understand that they own and must control the requirements for their systems. This means being sufficiently informed of sound analysis models and artifacts to identify needs, directions, and requirements for information technology systems, as well as staff training needs.

Developing broad consensus
Both economic and programmatic forces are pushing public health toward more collaborative ways to formulate policies, define standardized practices, and document operational requirements, as well as to share services at the implementation level. Such collaborations benefit from a disciplined and systematic methodology to help ensure thorough examination and accurate documentation of public health programs, as well as consensus and acceptance of developed guidelines in the community of practice.

Quality improvement
Rather than every health department independently working to solve common problems, the collective intelligence and wisdom of many can be harvested through collaborative methods to develop solutions. Common problems should drive common solutions. Bringing public health practitioners together to systematically analyze and understand those problems, in our experience, leads to more thoughtful policies, more complete guidance, and more effective strategies than any one agency could develop working alone. To the extent these collaboratively developed solutions are implemented at the agency level, they help to both raise the quality of that agency programs and help to standardize practice across the country[3]. It is, in effect, enabling the development and implementation of promising or best practices.

Cost savings
Use of systematic approaches can also lead to greater cost savings. Another form of cost savings is in IT system design, for instance by preventing costly cycles of software development that come from not having clear requirements upfront. Without clear requirements driven by program needs, software developers, whether internal to an agency or commercial, will either guess what the program needs or push the developer's preferred system design. Rigorous analysis and documentation help ease relationships with both developers and central IT departments as program staff learn to document their needs at the level of specificity needed by developers.

In the case of collaborative nationwide efforts, the cost savings can come from having many minds jointly develop the requirements, then from reusing the same requirements across multiple jurisdictions to cost-effectively develop solutions, whether individual or shared solutions. Also, when multiple jurisdictions align their operations and information system design with consensus-based best practices and standards, more uniform (and scientifically valid) data are possible for inter-jurisdictional data exchange and for national analysis.

Improved system design and functionality
Another benefit of systematic requirements development is improved and more uniform IT system design, functioning and interoperability. Well-designed systems are more likely to adhere to nationally-accepted standards, whether for the data elements (e.g., code sets, value), message structure (e.g., HL7), transport (SOAP web services, SFTP), or security (HIPAA security rules). Information systems that are well designed to interoperate with those of public health's

community partners save staff time and frustration on both ends, while also supporting improved data quality.

Longer "shelf life"

Lastly, systematic collaborative methods provide the due diligence necessary when exploring whether to take advantage of new technologies, such as cloud computing and open source solutions. Because the artifacts of a rigorous process, such as business rules and strategies, are well thought out from the operational (or "business") perspective of public health programs, they tend to preserve the institutional knowledge and have a long impact that is independent of specific technologies. In fact, the artifacts can be adapted to different technologies as they evolve because the fundamentals of the public health operations are well documented. In other words, the "business needs" will have driven the technological solutions, not the other way around.

What we are advocating for is not only—or even mostly—about technology: it's about creating a collaborative culture of working smarter to improve program performance and technology investments. This culture, one that insists on use of systematic collaborative methods, starts at the policy level and permeates the entire agency or program area nationally.

Practice Implications

How can senior leaders and program managers use these systematic collaborative approaches in their roles and program areas? The following are practical recommendations for decision makers facing today's public health challenges.

Senior Leaders:

- Learn to ask questions during large information system projects, such as, "What form of analysis was conducted in creating this RFP/statement of work?", "Who was involved?", and "Do the main stakeholders, including the end users, understand these requirements/guidelines and agree to them?"
- Be aware of the extent to which these systematic collaborative methods can support the agency's goals both programmatically and in terms of reducing cost or yielding better value for the same cost. Learn about where these methods have been successfully used in areas of public health [14, 15, 20-26] and other industries [27, 28], and how they might be applied to meet an agency's needs.
- Review the Department of Health and Human Services Enterprise Architecture Framework [29] for a useful practical guide for systematic approaches to identify opportunities and improve processes and operations.
- From the beginning, plan on engaging consultants with a proper skill set [4, 5] to help your department or agency get going with collaborative analysis approach, to give briefings and guide training for your staff, and help to lay out a work plan.
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Program Managers:

- Collaborate with partners and stakeholders to build community consensus on common guidelines and practices. Work with professional association(s) to both seek out and share information on using these methods and available artifacts.
- Use proven approaches of business analysis and modeling to analyze problems and to formulate and document solutions. Ensure that the Why, Who, What, When, Where, How questions (see Figure 1) are well understood. Note that many practical tools and guides can be found at the CDC's Unified Process website, for example, in the practice guide on modeling [30].
- Leverage requirements and solutions that have already been developed by other agencies. Remember that the work of public health agencies is more alike than dissimilar, so operational requirements and other work products are likely to meet a significant portion of another agency's needs. That can be a big part of eventual cost savings for any given project.
- Start small, experimenting with collaborative systematic approaches for problems limited in scope—for example, for the next round of enhancements to a program's operations

manual. Then ensure that future projects have a level of rigor appropriate to the size, cost, risk level and visibility of the project.

- Assemble proper multidisciplinary skills when using these methods; i.e., bring together people who have programmatic expertise, skills in modeling and analyzing workflows, facilitation/consensus building skills, and knowledge of national standards. Identify appropriate staff and seek out both the external training and the internal opportunities for putting these skills into practice.

Conclusions

Working together in applying rigorous, collaborative approaches to establishing common guidelines and solving shared problems is well-suited to the demands of the day in public health, especially those of rising expectations for sophisticated uses of information and information technology, and dwindling human and financial resources. The approach described in this paper is not just about technology, but rather about transcending public health's historical "siloed" approach to building program and agency capacity and information system capabilities.

Certainly, collaborative efforts may take longer compare to each stakeholder or each part of the public health program working on the solution alone. A lot of patience needed to be successful. But joint efforts pay off in the end and, therefore, well worth the investment. As the African proverb puts it, "If you want to travel fast, go alone. If you want to travel far, go together."

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