Using Quality Improvement Methods To Improve Public Health Emergency Preparedness: PREPARE For Pandemic Influenza

A promising model for improving preparedness, with some real-life success stories.

by Debra Lotstein, Michael Seid, Karen Ricci, Kristin Leuschner, Peter Margolis, and Nicole Lurie

ABSTRACT: Many public health departments seek to improve their capability to respond to large-scale events such as an influenza pandemic. Quality improvement (QI), a structured approach to improving performance, has not been widely applied in public health. We developed and tested a pilot QI collaborative to explore whether QI could help public health departments improve their pandemic preparedness. We demonstrated that this is a promising model for improving public health preparedness and may be useful for improving public health performance overall. Further efforts are needed, however, to encourage the robust implementation of QI in public health. [Health Affairs 27, no. 5 (2008): w328–w339 (published online 15 July 2008; 10.1377/hlthaff.27.5.w328)]

Public health emergency preparedness (PHEP), although only part of what public health agencies do, has been the focus of much attention. The federal government has invested $5 billion in PHEP since 2001, heightening expectations about whether the nation is “ready” for the next large-scale emergency.¹ Many recent PHEP efforts have been directed toward preparing for pandemic influenza, which represents one of the most catastrophic global health

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threats. PHEP requires both the ability to perform traditional core public health functions—including disease surveillance (monitoring patterns of flulike illness), case investigation (ensuring rapid laboratory diagnosis and contact tracing for people with unusual illnesses), public education, mobilization of community partnerships, and assurance that medical care is provided—and the ability to perform other less familiar functions, including rapid staff activation using the Incident Command System (ICS); implementation of a quarantine; and coordination with traditional first responders, such as police and fire departments.

Several studies have documented variation in preparedness across public health agencies; others have noted that few systematic efforts exist within public health to close gaps in preparedness once they have been identified or to define a consistent approach for improving performance. Practitioners report that lessons learned in the field (for example, during an outbreak investigation or public information campaign) do not routinely stimulate systematic change. Similarly, lessons from preparedness drills and exercises, although commonplace, are often not acted upon. In many, if not most, cases, health departments and preparedness managers lack a clear understanding of how to improve their readiness.

These issues have led to calls for a greater use of quality improvement (QI) in PHEP—that is, a systematic approach for understanding and measuring performance, identifying solutions to performance shortfalls, and implementing changes to improve outcomes. Originally developed in manufacturing, QI broadly refers to a set of concepts and methods geared toward improving the ability of a product or services to meet consumers’ needs. QI approaches involve a set of core elements, including an understanding of the problem in system terms, the will to change, the use of data to implement and track changes, and the sequential building of knowledge from testing through implementation. Performance measurement is especially critical to QI, as a means to understand reasons for variation or gaps in performance and to test the impact of potential improvements to the system.

The use of QI methods is now commonplace in the health care delivery sector, spurred in part by two Institute of Medicine (IOM) reports, which documented systemwide failures in safety and quality in health care. The subsequent use of QI methods in health care delivery has led to many improvements, including increased use of recommended health care practices, improved patient safety, and decreased costs.

More recently, there have been nascent efforts to promote QI in public health, although there has been little QI activity in PHEP. Like health care, the PHEP system has as its ultimate outcome the health and well-being of individuals or the general population. This outcome is related to many factors, some of which are
outside the control of the delivery system or public health agency. However, PHEP differs greatly from much of health care system in that many key PHEP processes involve cooperation across sectors with shared responsibilities (while health care processes are generally under the control of health care providers). Most important, outcome measurement and evidence linking particular processes to desired outcomes is much less developed in PHEP than in health care. These differences create challenges in translating QI methodology for PHEP.

These challenges notwithstanding, PHEP seems primed to benefit from the clear expectations, measures of performance, and methods for change that are all part of QI. Indeed, without the application of specific methods designed to improve the performance of complex systems, it is unlikely that public health agencies will maximize their potential to meet the critical PHEP demands of the twenty-first century.

In this paper we describe a successful model for promoting QI in PHEP—the Promoting Emergency Preparedness and Readiness for Pandemic Influenza (PREPARE for PI), a pilot QI learning collaborative specifically around pandemic influenza preparedness—and discuss lessons learned about what is needed to promote a QI approach.

A Public Health QI Collaborative

We adapted the Institute for Healthcare Improvement’s (IHI’s) Breakthrough Series QI learning collaborative model, used successfully in health care, for public health agencies, with the overall objective of improving pandemic influenza preparedness. In a typical QI learning collaborative, a group of organizations (typically fifteen to twenty) work together over nine to twelve months to improve performance on a common set of goals, using shared tools and QI methods. Because this was a pilot, we asked only a small number of health departments to participate. We approached seven state and local health departments that we identified during past studies as exemplary or that were enthusiastic about learning to use QI methods in their agencies; five agreed to participate.

Each participating agency selected three or four people to make up the agency’s team. Teams were responsible for attending three in-person meetings (“learning sessions”) and conducting improvement activities for the agency. These one-and-a-half-day sessions included discussion of QI topics and a PHEP framework (described below), presentations from outside content experts, as well as team planning and sharing. Between learning sessions, teams received ongoing support from each other and from faculty members through monthly phone conferences. Teams submitted monthly progress reports detailing their activities and reporting performance data. We evaluated the collaborative based on the teams’ reports and on feedback received through an online survey and team interviews conducted at the conclusion of the collaborative.
QI Approach Used In The PREPARE For PI Collaborative

Prior to the start of the collaborative, an expert panel of nationally recognized public health leaders was convened to help develop a conceptual framework for PHEP and adapt a model for applying QI to PHEP.

We developed the PREPARE for PI framework to represent the system of pandemic influenza preparedness and to guide teams in identifying focal points for their QI efforts. Based on our review of the literature and RAND's past work with health departments around pandemic preparedness, the framework provides a high-level logic model specifying the key inputs, processes, and desired outcomes of PHEP efforts.

The PREPARE framework specifies five overarching domains or activities, which, if implemented effectively, would contribute to the desired outcomes of minimized morbidity, mortality, and social disruption in the event of an influenza pandemic (Exhibit 1).

The Model for Improvement, the QI model used in the Breakthrough Series, includes four components: (1) aims and goals; (2) performance measures, (3) strategies and ideas for changes, and (4) the use of plan-do-study-act (PDSA) cycles.

Based on their agency’s priorities, teams identified focused improvement aims. They chose operational performance measures related to the targeted process or outcome. Because of the lack of well-accepted measures of PHEP in general, faculty suggested a series of possible measures and targets for performance. Ideas for system changes relevant to each of the domains came from collaborative faculty and from sharing among the teams.

Teams implemented improvement efforts through small rapid-cycle tests of changes, or PDSA cycles. The PDSA approach is built on the premise that sustainable improvement is best achieved by multiple, successive, and initially small tests of change rather than the wholesale implementation of a predesigned program. The PDSA cycle, also known as the Shewhart cycle, encourages staff to develop and implement changes in phased, deliberate cycles: first planning for a pos-

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**EXHIBIT 1**
The PREPARE For PI Framework

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Preparedness activities</th>
<th>Desired outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threat or occurrence of health emergency</td>
<td>Surveillance</td>
<td>Minimized morbidity, mortality, and social disruption in the event of a pandemic</td>
</tr>
<tr>
<td>Alerts</td>
<td>Case investigation</td>
<td></td>
</tr>
<tr>
<td>Clinic/office visits</td>
<td>Command and control</td>
<td></td>
</tr>
<tr>
<td>ER visits</td>
<td>Risk communication</td>
<td></td>
</tr>
<tr>
<td>Pharmaceutical sales</td>
<td>Disease control and treatment</td>
<td></td>
</tr>
<tr>
<td>Sick days</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SOURCE:** Authors’ analysis.

**NOTES:** PREPARE for PI is Promoting Emergency Preparedness and Readiness for Pandemic Influenza. ER is emergency room.
sible change, then trying out a new idea or change in the smallest way possible, then studying the impact of the change, and then using the results to inform the next cycle of improvement (either by gradually building in scope on a successful change or by modifying or abandoning an unsuccessful change for something else).  

Teams developed personalized process maps for each of their chosen aims, modified from generic high-level maps developed by the faculty for each of the five domains. Process mapping is a fundamental QI tool to identify the steps in a process and develop measures for testing and targets for improvement. The maps depict key inputs or triggering events for a process and desired outcomes. The process maps helped teams identify performance goals and measures, and the teams conducted multiple PDSA cycles around different components of their process maps.

We encouraged teams to integrate their improvement work with their day-to-day public health activities. This emphasis can help address “preparedness burnout,” which can be common when staff is asked to spend time away from routine demands to plan for relatively infrequent emergencies.

**Health Departments’ Experiences With QI**

During the nine months of the collaborative, teams worked at their home agencies on measuring performance and testing a number of the ideas for change. Here we highlight examples from the participating teams, who as a group focused on three domains: command and control, disease control and treatment, and risk communication.

- **Command and control.** Effective command and control requires an organization to reach and mobilize staff and activate the ICS quickly and to work effectively in its response roles while coordinating with relevant partners.

  The Genesee County Health Department (GCHD) in Michigan wanted to improve its ability to mobilize staff rapidly during an emergency. The GCHD’s tests focused on two aspects of performance: whether 100 percent of staff could respond to an alert message within ninety minutes (their process goal) and how performance varied depending on the communication method used (such as e-mail or fax). In their initial e-mail test, only 50 percent of nonabsent staff responded within ninety minutes, and 25 percent of staff did not respond at all. After modifying the e-mail instructions, the ninety-minute response rate improved to 83 percent, and nonresponders decreased to 5 percent.

  Although they did not achieve the targeted 100 percent response rate, the tests proved valuable by giving a baseline for future improvements. They also demonstrated that a small, easy-to-implement change markedly improved performance. The GCHD’s team leaders have commented that since the tests and the accompanying small changes in procedures, staff have improved their ability to respond to a range of requests.

- **Disease control and treatment.** Examples of activities in this domain include
the ability to implement community mitigation strategies, to implement rapid triage, and to support the surge capacity of the medical system to care for those who are ill.

The Georgia Division of Public Health (GDPH) decided to develop a nurse-staffed triage and decision-support phone line to give advice to patients not sick enough to require in-person evaluation during a pandemic. First, team members developed a relationship with a local hospital to learn more about its process for running a triage line and to build a potential partnership for staffing one. The team also planned a PDSA cycle around a mock call scenario in which the triage was performed by a nurse working in the epidemiology section. Subsequent tests used nurses with different training and alternative call scenarios to gain experience with a broader range of presenting symptoms. Through repeated PDSA cycles, the health department found that public health nurses with front-line responsibilities were able to complete calls more efficiently. Data from these small tests provided realistic estimates of staffing and resource requirements for a triage line and illustrated that with careful selection and training to ensure faster call takers, the GDPH would be able to handle a larger volume of calls. Further, the improvement process enabled the GDPH team to enlist the support and buy-in of nursing staff in the development of the triage line, despite earlier resistance.

The Multnomah County Health Department (MCHD), based in Portland, Oregon, worked on its ability to respond to emergency requests from hospitals for medical supplies and volunteers to make up for staff shortages during a pandemic emergency. After multiple PDSA cycles testing and modifying ordering and volunteer call-up procedures, the team measured the time needed for agency staff to process hypothetical orders from hospitals during a large scale pandemic flu exercise. Their results for addressing supply requests fell short of their goals, indicating that, because of a lack of standardization and poor communication between the hospitals and the agency, many orders took a long time to process, and some could not be processed at all. Having objective measures of performance helped the team more effectively demonstrate the need for improvement and provided a performance baseline. These activities also helped clarify the roles and responsibilities of the public health agency and its hospital partners, and engage their partners in improvement efforts to address the lack of standardization. Their experiences highlight how improving activities outside of the direct control of the health department can require additional efforts to reach desired performance targets.

Risk communication. During an emergency, health departments must quickly disseminate critical health messages to the public.

The Virginia Department of Health’s (VDH’s) experience illustrates the importance of drawing upon day-to-day activities in building PHEP capacity. The VDH wanted to improve its risk communication capacity by developing a telephone hotline, or Public Inquiry Center (PIC). Initially, the state’s emergency plan had called for the public health PIC to be run by the Department of Motor Vehicles
(DMV). However, health department staff had concerns about this model. With encouragement from collaborative faculty to look for day-to-day activities that are similar to preparedness activities, staff identified the department’s own sexually transmitted disease (STD) hotline. They realized that there was much to learn from this internal resource; further, staff from the STD hotline were willing to help run the PIC during emergencies.

The team mapped out key steps in activating a PIC and then repeatedly tested and modified each of the required processes. For example, after repeated tests and changes, Virginia decreased the time needed for one of the steps in the PIC activation process from two hours to thirty minutes. The team then used a statewide pandemic exercise to execute all aspects of the PIC setup. As noted by one agency official, developing the hotline through multiple PDSA cycles “really did move things along, instead of waiting for one big way to test [the hotline]. It was a way of seeing [that] you could make progress in shorter periods of time.”

The Baltimore City Health Department (BCHD) also focused on risk communication. Staff tested various messages and communication strategies during a back-to-school vaccination campaign. They found that inexpensive letters sent home with children were more effective with parents than a citywide ad campaign (63 percent of parents bringing children to vaccination clinics reported getting information from the letters, while only 10 percent cited ads). Although a letter campaign might not be appropriate for some emergency situations, the BCHD learned a valuable lesson in how to assess the efficacy of their risk communication with the public. Moreover, the BCHD attributes its success in reaching its citywide school vaccination targets to the improved communication with the public and internal teamwork from participating in PREPARE.

Also in the risk communication domain, the GCHD decreased the amount of time needed to get emergency messages approved and disseminated, ultimately decreasing the approval time from eight hours to two.

**Assessment Of The Collaborative Experience**

**Improved agency preparedness.** The “gold standard” for improvement might be improved performance on process measures that are clearly linked to important preparedness outcomes. However, these types of metrics are not yet available in PHEP; furthermore, as the teams worked in different domains, we could not directly compare performance across sites and did not attempt to assess overall preparedness. Despite these limitations, there was substantial evidence that this QI model was helpful in improving preparedness.19

Teams moved from planning to implementation on a number of strategies crucial to their agencies’ preparedness efforts. Overall, teams found that the PDSA process of conducting small tests gave them a structure for developing and testing their activities at minimal cost. They also benefited by establishing a baseline of performance that could be used to set goals for future improvement and to mea-
“The majority of the PREPARE for PI participants felt that the pilot learning collaborative was valuable.”

Teams were able to build preparedness by improving on measures of performance or by strengthening relationships with internal and external partners, or both. For example, the VDH decreased the time needed to set up its phone lines, while the GCHD shortened the time needed to send out emergency communications.

All of the teams benefited from stronger partnerships. Some strengthened their internal teams through their QI activities, while others strengthened partnerships with community hospitals.

\textbf{Successful adoption of QI methods for PHEP.} Overall, the teams were enthusiastic about applying QI to their PHEP efforts and to their day-to-day activities. In their feedback, participants told us more specifically about the aspects of the QI approach that they found most useful.

Breaking broad preparedness concepts into pieces that could be acted upon provided a manageable approach to PHEP efforts for team members. Participants found the process maps especially useful for identifying subprocesses and intermediate performance measures for preparedness goals. A team member from the VDH noted, “A lot of time in preparedness planning we have lofty goals, and it is helpful to break [the plans] down into smaller pieces and work and test those as we go along.”

Moreover, the ability to use QI methods has been sustainable, because many have used QI methods to improve performance even after the formal collaborative period ended. Overall, the teams have said that they plan to continue using QI. In our postcollaborative survey, the average rating for how likely participants were to use QI methods in their future work was 4.2, on a scale from 1 (not at all likely) to 5 (very likely). At some agencies, former collaborative members have become local experts in QI, and their supervisors and colleagues are seeking them out for collaboration on QI efforts outside of preparedness.

Team members noted a number of supports that would facilitate their ability to continue using QI, including the involvement and support of senior leaders, the existence of other QI-related efforts within their organization, a business orientation within the organization, and additional training in QI methods. Some noted that reluctant staff members in their agencies could pose a barrier to future efforts and would need encouragement and the opportunity to learn about past successes using QI methods.

The majority of the PREPARE for PI participants felt that the pilot learning collaborative was valuable. During the collaborative, health departments used each other as resources for new ideas and as sources of support in facing challenges.
Teams reported that the face-to-face time with both QI and preparedness experts (during calls and learning sessions) was especially helpful. Participants also improved their understanding of their colleagues’ roles and learned how to make better use of internal resources in their agencies.

There was some initial skepticism about the PREPARE approach, coming generally in two forms. The first was from public health staff working primarily outside of emergency preparedness (for example, in communications or epidemiology), who were skeptical about working in emergency preparedness. These people became more engaged and less reluctant as they were able to see how PREPARE allowed them to improve high-priority day-to-day activities along with PHEP functions and to clarify PHEP processes and outcomes. A second form of reluctance came from full-time emergency preparedness personnel, who were initially hesitant to combine day-to-day public health functions with preparedness activities. They were most engaged by seeing how the PREPARE teams’ efforts allowed agencies to collect high-priority, objective performance measures for PHEP functions.

Although all of the teams made major gains, teams that progressed more quickly were able to identify relatively simple ways to measure performance and test improvements. Also, processes that involved only health department staff and occurred fairly often lent themselves more easily to QI efforts (for example, staff call-down activities). We also found that teams that met more frequently and were more united around their team aim made more progress than others. Furthermore, the teams’ work covered a broad range of content areas; as a collaborative, we tried to provide resources applicable to all of the areas, but because of time limitations, we covered some areas more extensively (such as risk communication). Teams that focused on more unique areas were at a relative disadvantage in terms of sharing tools and ideas with others in the collaborative.

Policy Implications

The PREPARE for PI experience demonstrates the potential for QI successes within public health agencies and the value of collaboration in helping agencies learn and apply QI methods. At the same time, the expansion and continued success of QI in public health will require the efforts of multiple stakeholders, including government and the research community. Some approaches are described below.

- **Clarify public health processes and develop reliable measures.** QI in the health care sector has been aided by a large body of work to develop measures of the structure, process, and outcome components of quality. Public health needs a similar effort. Validated metrics are needed to allow agencies to effectively track performance over time. Developing measures should be, at a minimum, the shared responsibility of the public health community, academe, and government. Such an effort will likely require sizable financial support.
PHEP has been particularly challenging to measure, in part because of the lack of clarity about what constitutes preparedness, and also because of the infrequency of large-scale emergency events. Recently completed work helping address these issues includes an expert-panel process, which resulted in a consensus definition of PHEP and its key elements, projects to develop measurement strategies and drills for distributing the strategic national stockpile, and assessing round-the-clock case investigation capabilities. These efforts should be invigorated by the call for measures embodied in the Pandemic and All-Hazards Preparedness Act (2006).22

Create the right incentives. Increasing the breadth and depth of QI practices will require public health agencies to be held accountable for their performance and committed to continuous improvement. Both financial and nonfinancial incentives can help make these expectations concrete. Financial incentives for QI could be operationalized by tying the release of federal or state dollars to performance improvement or to the institutionalization of certain QI practices (for example, repeated performance measurement). Alternatively, appropriation of extra funds for QI might be tied to actions deemed to be indicative of a jurisdiction's commitment to quality improvement (for example, via staffing decisions, release of performance-related information, and modest levels of prior investment in quality improvement) or to participation in formal QI programs (such as “pay-for-participation”).23 Recognition of team achievements within a given agency may also be helpful. However, policymakers should carefully examine incentive schemes to ensure that they do not generate unintended consequences, such as by punishing underperforming departments and thereby leaving those most in need of improvement with fewer resources to commit to such efforts.24

Policies requiring open recognition of public health agency quality might create another incentive by bringing favorable publicity to high-performing public health departments.

Create a base of expertise in QI in public health. The discipline of QI and the skills and techniques needed to pursue it must be broadly disseminated throughout the public health community. Essential skills include knowing how to choose appropriate outcomes, writing measurable goals, analyzing and understanding work processes, choosing and implementing small tests of process change, and evaluating the effectiveness of those small tests. A base of “learning organizations” and a cadre of individual QI trainers who can “speak the language” of public health practitioners are also needed to spread QI in public health.25 Some potential approaches for developing such leaders include training groups through public health leadership institutes.26 The U.S. Department of Health and Human Services—

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in particular, the Centers for Disease Control and Prevention (CDC)—could play a role in making the initial investment to develop this base and promoting it to health departments nationally.

- **Demonstrate and evaluate larger-scale QI efforts.** A broad array of well-documented demonstrations of QI in public health could show clearly how QI applies to the field. Stories of successful improvement, such as those described in this paper, demonstrate that change is possible and show what it will take to get there. Importantly, these examples illustrate that QI is not an “add-on” to regular work, but rather a process for improving regular work. Following the demonstration of feasibility and efficacy with this pilot effort, an important next step is the evaluation of larger-scale QI efforts focusing on the effectiveness and efficiency of models for disseminating QI methods in public health.

Results from the PREPARE for PI Learning Collaborative were presented at the following meetings: the AcademyHealth Annual Research Meeting, Orlando, Florida, 4 June 2007; the annual meeting of the Association of State and Territorial Health Officers (ASTHO), St. Louis, Missouri, 4 October 2007; and the Public Health Preparedness Summit, Atlanta, Georgia, 21 February 2008. This work was supported in part by funding from the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response (Contract no. 233-200-5002-14U), and by the Robert Wood Johnson Foundation (Contract no. 58603). However, the opinions expressed herein are solely those of the authors. The authors wish to acknowledge all of the members of the PREPARE for PI Learning Collaborative, including members of the participating health departments: Baltimore City Health Department (Maryland), Genesee County Health Department (Michigan), Georgia Division of Public Health, Multnomah County Health Department (Oregon), and the Virginia Department of Health; and additional PREPARE faculty and staff: Lisa Rubinstein, Divvie Powell, Amanda Cornett, and Jennifer Li.

**NOTES**


14. A list of ideas for system change is available on request from the authors; send e-mail to Debra Lotstein, Lotstein@rand.org.


16. Ibid.

17. Seid et al., “Quality Improvement.”

18. The process map modified to describe this activity can be found in Online Supplement 1 at http://content.healthaffairs.org/cgi/content/full/hlthaff.27.5.w328/DC2.

19. Findings from our assessment of the collaborative are available in Online Supplement 2; ibid.

20. Ibid.


26. Examples include the Association of State and Territorial Health Officers (ASTHO), National Association of City and County Health Officers (NACCHO), the National Network of Public Health Institutes, and the Public Health Foundation.