

Quality Improvement Interventions in Public Health Systems

A Systematic Review

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Context: Public health leaders are making difficult decisions about how to maximize the effectiveness of public health services with diminishing funds. Quality improvement (QI) interventions seek to improve the efficiency and effectiveness of public health programs, services, or organizations. The purpose of this study was to review the literature to describe public health system QI interventions and their impact on public health practices and health outcomes.

Evidence acquisition: A systematic review was conducted using PRISMA guidelines. Three databases were searched for peer-reviewed articles that included public health quality improvement-related terms in their abstracts. Articles published in 1990–2010 that described results from QI interventions conducted within the U.S. public health system were included.

Evidence synthesis: Fifteen studies were identified, reporting on 18 separate QI interventions. Studies fell naturally into three functional categories: organization-wide QI, program- or service-specific QI, and administrative or management function QI. Few of the studies linked their improvements directly to a health outcome or predictors of health outcomes. Studies generally were implemented in state-level or large local public health departments.

Conclusions: Formally published QI interventions may not be representative of typical, smaller-scale QI activities. Collection and distribution of QI results associated with proven, effective public health interventions and that quantify the benefits of QI practices in public health should be a goal. More research is needed to definitively “connect the dots” between QI efforts, resulting practice improvements, and actual (or predictors of) health outcome improvements. Future studies should examine QI in diverse public health systems.

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Context

Public health leaders are now making difficult decisions about how to use limited resources to maintain essential public health services and how to improve most effectively the health of their populations through the services they provide.¹ Performance management, using data to improve programs with respect to established targets and goals (known as performance standards), is increasingly seen by public health leaders as

a useful practice.² Quality improvement (QI, also known as performance improvement) is one specific component of performance management. QI applies interventions to improve the efficiency or effectiveness of a program, process or organization, including by eliminating “inefficiency, error and redundancy.”^{2,3} QI processes have been institutionalized in other fields such as manufacturing, transportation, law enforcement, and clinical health care.^{4–6}

To “improve performance,” a clear vision for high-quality public health systems must be articulated, so that efforts to improve those systems can include specific goals. Public health performance measures, a set of targets or goals with “standards” as thresholds for acceptable performance, have been established for U.S. state and local public health departments within the public health system and currently are being beta-tested for national use in an accreditation program.⁷ Accreditation indicates that an organization has met levels of expected perfor-

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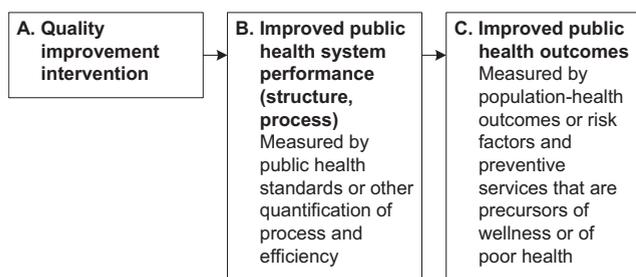


Figure 1. Theoretic model for public health quality improvement initiatives

mance, measured using the established standards. For state and local public health departments, QI interventions are expected increasingly to be implemented in connection with the goal of achieving measures of performance related to emerging measures of public health standards and accreditation.⁸

In conjunction with development and testing of public health standards, a number of performance management initiatives have been launched in the U.S.^{2,9,10} Results from these state and local public health system participants in these pilot initiatives have provided a science and practice base for public health performance management, including QI. As the science base for QI in the context of public health practice is developing, it is useful to summarize what has been demonstrated to date.

The purpose of this review was to identify published studies that described QI initiatives implemented in the U.S. public health system and associations with public health service performance or health outcomes. Assumptions about how QI initiatives affect public health were influenced by Donabedian's¹¹ structure–process–outcome framework, which has been used widely in efforts to measure and improve the quality of health care. The current review was based on the theory (Figure 1) that QI interventions (A) are applied for the purpose of improving public health service performance (B), which leads to improvements in the public's health (C). For example, improvements in the public's health may be the goals established in *Healthy People 2010*.¹² Thus, the current review identified and examined studies that reported on QI interventions and either performance-related or outcome-related results. PRISMA guidelines were used to guide procedures for the review.¹³

Evidence Acquisition

Peer-reviewed journal articles were identified using MEDLINE (via PubMed) and Academic Search Complete/EBSCO (also applying limits for: scholarly/peer-reviewed journals; subject: public health; and geography: U.S.). The search term *public health* was applied in combination with any of the following terms: *performance management*, *quality improvement*, *performance measure-*

ment, *performance improvement*, and *performance standards*. These terms were chosen for their description as core components of public health performance management and QI in the Turning Point Performance Management Collaborative, an early public health performance management initiative.¹⁰ The search was limited to articles published from 1990 through November 2010, to reflect public health system activity that would have taken place after the 1988 IOM report *The Future of Public Health*.¹⁴

Additionally, the National Association of County and City Health Officials (NACCHO) "Model Practices Database" also was used to search for articles using the keyword *quality improvement*. This database includes reports of public health initiatives (programs, resources, or tools), including in public health infrastructure and systems, that have been reviewed by public health experts and determined to be "model" or "promising" examples that provide guidance to public health practice.

Only studies of QI initiatives that described results, in terms of practice improvements or health outcomes, were included. For these studies, the context, objectives, evaluation methods, interventions, and conclusions were detailed. No authors were contacted for additional data other than those contained in the published studies.

Evidence Synthesis

The search strategies employed yielded a total of 854 articles (Figure 2). After screening titles and abstracts for articles that were specifically related to the U.S. public health system, and removing duplicates, a total of 138 articles remained. From among these 138 identified studies, abstracts were reviewed to eliminate articles that described QI in clinical practice settings, where the QI interventions were focused on clinical practice changes rather than the public health system (4).

Additional articles were excluded that did not include a description of a QI intervention and results (some were commentaries or conceptual descriptions of potential QI models [66]; others reported on assessment projects or capacity building for QI, but not actual QI, projects [39]; and some described the process of QI efforts without

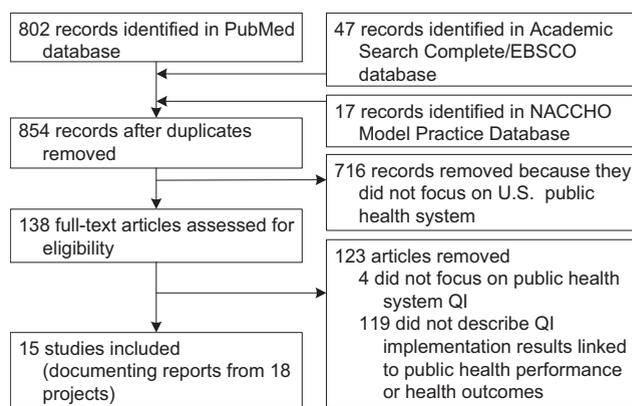


Figure 2. Systematic review phases
NACCHO, National Association of County and City Health Officials; QI, quality improvement

describing results [12]). Fifteen articles remained that described implementation and reported results of 18 specific QI-related interventions. One article (Mason et al.¹⁵) reported in detail on four separate QI interventions, and these were treated as separate studies in Table 1.^{15–28}

Study Summary by Functional Groupings

The 18 interventions that fit the inclusion criteria fell naturally into three functional categories: organization-wide QI-related initiatives (seven studies); specific program- or service-oriented QI projects (seven studies); and administrative or management function QI activities (four studies). Detailed information about the studies is given in Table 1, organized by functional category, and aligned with the Theoretical Model (Figure 1).

Functional Category 1: organization-wide quality improvement interventions. Four of the studies described organization-wide QI initiatives that used a systems approach (such as establishing an organizational team or standard approach for QI) and were intended to influence multiple programs or services. Beitsch et al.¹⁶ reported on health indicator trends as the outcome of their organization-wide QI-related intervention in Florida. These authors reported that 11 of 14 key health indicators for the state as a whole were improved from 1991 to 1998, following a statewide QI initiative. Riley et al.²⁰ reported on some proven health predictors as results (including receipt of fluoride treatment) and some practice-based performance results (reducing time required for documentation in a tuberculosis clinic). Gunzenhauser et al.¹⁷ implied that QI initiatives were linked with improved immunizations (a health outcome predictor).

The remaining organization-wide QI studies did not attempt to link findings to health outcomes or predictors of health outcomes, but rather described outcomes related to the systemwide integration of QI or related initiatives. Mason et al.¹⁵ reported an increase in programs meeting the Public Health Standard for establishing quantifiable performance indicators in both Washington State's Department of Health and a county health department. Reedy et al.¹⁹ reported improvements in the development of program evaluation plans, and Kushion et al.¹⁸ reported improvements in institutionalization of QI across programs.

Functional Category 2: program- or service-related improvement interventions. Seven studies detailed QI efforts that were intended to influence a specific program or service. Two studies reported on efforts to decrease the wait time for clients of the federally funded U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants and Children (WIC) health and nutrition program.^{22,23} The first study was con-

ducted in a single WIC facility, and primarily tracked client wait time to assess the influence of clinic adjustments to improve client flow over time and reported success in reducing wait time by about one third.²² Green et al.,²³ in contrast, monitored wait time in intervention and comparison WIC programs and did not observe changes in wait time associated with QI efforts. Both authors noted that client wait time is inversely associated with satisfaction, which also is associated with continued participation in WIC programs, and that participation in WIC programs previously has been associated with better health outcomes.

Mason et al.¹⁵ reported on two specific efforts. In the first, a health department identified "best" and "worst" sites for complete documentation of race/ethnicity within sexually transmitted disease-reporting systems. A contrast of sites with different levels of performance was used to identify reporting barriers and to develop an educational intervention that improved the quality of documentation by staff. This practice improvement was not linked directly to health outcomes. In the second effort, two health departments identified specific sites with high rates of untreated Chlamydia infection and targeted interventions to improve treatment. Treatment of Chlamydia has a direct effect on improvement of patient health.

Lotstein et al.²⁴ reported on process improvements in five separate state public health pandemic influenza response teams. Although the authors indicated that a high-performing response system should have better health outcomes than lower-performing systems in the event of a pandemic influenza emergency, they noted that until the system is tested, no one can be sure. Barron and colleagues²¹ described a QI effort to align environmental health program services with essential public health services. The authors reported improved capacity for environmental health but did not attempt to link this capacity change to health outcomes.

The Stanislaus County Public Health Department²⁵ described improvement efforts centered on the health department's function of providing health data and information to the community. Specifically, a health department used stakeholder input to improve its data and publications website. Measures of website visits and downloading of reports from the website were improved, suggesting that more people were aware of and using data provided by the health department.

Functional Category 3: administrative or management practice improvements. The final four studies described QI interventions that were intended to improve specific administrative or management practices within their public health organizations. The Hanover

Table 1. QI initiatives in public health systems

Study	A. QI Initiative					B. public health system performance	C. public health outcomes
	Context	Objectives	Methods for evaluation	Intervention	Findings/conclusions		
	State or local organization, location, impetus	What were they trying to influence?	What data did they use to measure change?	Specific QI action taken?	What did they learn?	Link to “better” practice process measures?	Link to “better” population health?
Functional Category 1: Studies of organization-wide QI							
Beitsch (2000) ¹⁶ Study period: 10 years, 1990–2000	Florida, state and local public health Impetus: long-time statewide focus on quality assurance	Implementation of systematic QI for all programs	Examined sentinel health indicators in 1991 and 1998	Implemented five QI steps at each of 67 local health departments on a 3-year rotating cycle: (1) self-assessment of statewide health indicators and administrative functioning by local HD; (2) program review led by state content experts; (3) systems review; (4) cooperative agreements for improvement; (5) follow-up to document completion of agreements	Integration of QI processes resource-intensive but perceived as beneficial	Improved QI practices	Improvements in 11 of 14 health outcome indicators over 10 years; declines in infant mortality (especially nonwhite infant mortality) and tuberculosis case rates; declines were greater than national trends.
Gunzenhauser (2010) ¹⁷ Study period: 2002–2009	Los Angeles County Health Department CA Impetus: agency interest (not participating in, but following lead of Multi-State Learning Collaborative)	Systematic QI in three key areas across programs: (1) performance improvement; (2) professional practice and; (3) public health science	Collected and reviewed “public health report card” measures describing presence of specific infrastructure components within three areas: organizational effectiveness, workforce excellence, fiscal accountability Examined survey data from staff to assess degree of service provided by administration (baseline only) Reviewed process steps for implementation of QI initiatives	Established a Division of Quality Improvement, one-on-one consultation to directors of nearly 40 programs: (1) accountability framework and program performance measures; (2) employee duty statements and recognition; and (3) evidence-based practice reviews, journal clubs, and a science fair established	Cannot hold public health accountable for all population-based health outcomes Leadership, shared vision, and transparency (for public accountability) are important QI offers response to call for accountability from the public	Improve essential public health services for: competent workforce, evaluation, and research	Implied linkage of initiative to improved hepatitis A incidence rate, increased polio immunization for children (no comparison group)

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Table 1. QI initiatives in public health systems (continued)

Study	A. QI Initiative					B. public health system performance	C. public health outcomes
	Context	Objectives	Methods for evaluation	Intervention	Findings/conclusions		
Kushion (2007) ¹⁸ Study period: unclear	Michigan State Department of Health Impetus: Multi-State Learning Collaborative	Implement improvements recommended by a QI workgroup Create interactive learning environment for accreditation	Reviewed process steps for implementation of QI initiatives; established plans to collect participant feedback after further implementation	Implemented initiatives in three tracks: (1) a voluntary continuous QI model for local health departments; (2) model and tools for improving local-state accreditation discussion; (3) digital library for accreditation-related information	Success of processes and products not yet determined	Integrate QI into practice	Not linked specifically to health outcomes
Mason (2010) ¹⁵ Study period: 2006–2009	Washington State Department of Health and statewide public health system Impetus: existing commitment to QI; Multi-State Learning Collaborative	Implement standard to “establish quantifiable program outcome measures” (systemwide performance measures)	Examined performance standard review scores for 2002, 2005, and 2008 cycles	Agency-wide QI team established, training provided to staff, leadership directive to establish outcome measures for programs	Percentage state HD programs meeting standard increased from 7%–19% in 2005 to 84% in 2008	Improve relevant public health standards performance	26 health indicators were reported annually at the county level; however, results of the systematic QI initiative were not described as affecting these measures.
Mason, Schmidt (2010) ¹⁵ Study period: 2006–2009	Tacoma-Pierce County Health Department Impetus: state standards review; Multi-State Learning Collaborative	Implement QI infrastructure and processes	Reviewed performance standard scores for 2002, 2005, and 2008 cycles: Tacoma scored 0 of 4 for QI measures in 2005	Agency-wide QI team established, training provided to staff, leadership directive to establish outcome measures for programs	Sustained QI activity integrated into system: ongoing QI activities, quarterly review of program- and department-level performance measures Agency scored 4 of 4 on standards review for QI measures in 2008	Establish QI infrastructure	Not linked specifically to health outcomes
Reedy (2005) ¹⁹ Study period: 2002–2003	Santa Clara County Department of Public Health CA Impetus: agency interest	Standardize and implement program evaluation across 40 public health programs/services	Examined process measures: plan completion, number of objectives (met/not met)	Implemented three initiatives: (1) training in an evaluation framework; (2) information systems development, tools and technical assistance; (3) management performance agreements to include evaluation	Evaluation plans mostly successfully institutionalized: 34 program evaluation plans developed; 29 implemented More work needed in outcome/impact evaluation, and using evaluation to improve programs	Improve standards for program evaluation	Not linked specifically to health outcomes

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Table 1. (continued)

Study	A. QI Initiative					B. public health system performance	C. public health outcomes
	Context	Objectives	Methods for evaluation	Intervention	Findings/conclusions		
Riley (2009) ²⁰ Study period: June 2007– March 2008	34 local health departments in Minnesota Impetus: Multi-State Learning Collaborative	Test feasibility and preliminary impact of a statewide QI training program to integrate QI in local health departments	Used pre-/post-training surveys to assess participant knowledge and motivation; monthly and final QI project reports	195 public health employees/managers participated in a distance education QI training, with expert support to implement projects.	High QI training satisfaction, motivation, knowledge Preliminary outcomes show improvement for six of eight projects	Weak results: WIC program appointment compliance; incorporate public health competencies in staff performance assessments. Strong results: decrease response time on action alerts; reduce documentation time in tuberculosis clinics; improve mental health screening for children	Strong results: increase dental fluoride treatment for children in WIC, which improves oral health
Functional Category 2: Studies of specific service- or program-related improvements							
Barron (2007) ²¹ Study period: May 2002– Sept 2004	Allegheny County Health Department PA Impetus: CDC cooperative agreement for “Building Environmental Health Capacity”	Improve capacity in Environmental Health department to carry out 10 Essential Public Health Services	Reviewed “capacity” measured by national public health performance standards at baseline and 2 years later	Prioritized capacity-building efforts based on results of baseline assessment; implemented activities to improve capacity	Standards were useful for measuring capacity. Improvement seen in most measured capacities (data analysis, performance tracking); declines seen in a few	Improve environmental health capacity	Not linked to health outcomes
Boe (2009) ²² Study period: 5 months; 12 months in 2005; 4 months in 2006	Dakota County MN; large WIC program (annual case load 70,000) Impetus: agency interest in efficiency	Decrease wait time in WIC programs; increase client satisfaction	Used statistical process control chart to track wait-time variations and changes by period; short ten-item surveys to assess client satisfaction	Implemented four-stage Plan-Do-Study-Act (PDSA) cycle: (1) baseline data collection; (2) process documentation; (3) implement new processes and document change; (4) lock in new processes	Clinic wait times were stable at baseline, method of approach was valid. Final re-engineering of process (revised floor patterns, redeploying personnel, staff training) reduced average wait time from 15 to 11 minutes and improved satisfaction.	Decrease wait time (and increase satisfaction); improve WIC participation	Authors note that improving WIC participation has been shown to improve health outcomes

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Table 1. QI initiatives in public health systems (continued)

Study	A. QI Initiative					B. public health system performance	C. public health outcomes
	Context	Objectives	Methods for evaluation	Intervention	Findings/conclusions		
Green (1998) ²³ Study period: 12 months, 1994–1995	Eight WIC sites in North Carolina (four pilot and four control) Impetus: agency interest in efficiency, federal focus on accountability	Determine if quality management training for WIC staff improved job satisfaction and customer satisfaction	Used a nonrandomized comparison group, pre–post test design, and collected data from staff and clients: 76 and 78 staff at control and pilot sites completed a self-administered survey about job satisfaction; 800 WIC clients surveyed via personal interviews about WIC service satisfaction; tracked client participation measures and wait times	Implemented four 4-hour workshops on quality management, used client surveys and staff surveys to prioritize improvement efforts, implemented improvement strategies	No significant improvement in staff satisfaction, suggesting need for continued focus on improving staff satisfaction Significant improvement in WIC customer participation at intervention sites versus control sites	Improve client satisfaction (known to be associated with WIC participation)	Authors note WIC participation has been shown to improve health outcomes.
Lotstein (2008) ²⁴	Five state and large local health departments Impetus: CDC preparedness grant, RWJF funding for QI	Improve response in preparedness domains: C and C: fast activation of staff C and T: implement medical treatment and triage RC: effective public communication	C and C: monitored changes in the percentage of staff responding to alerts in <90 minutes C and T: monitored time to complete calls from a call-in nurse triage system, monitored response time for hypothetical hospital requests for emergency supplies/volunteers RC: monitored telephone hotline implementation process, and response time; used parent surveys to measure awareness of information about vaccination for children related to different campaigns	Used “Breakthrough Series collaborative QI model”, with multiple cycles of change with teams of 3–4 people C and C: applied specific approaches to improve staff response time, such as testing e-mail versus fax notification C and T: used mock calls to test efficiencies in call-in nursing triage system; used pandemic influenza exercises to test response processes for emergency supplies/volunteers RC: tested efficiency of DMV telephone line as public response system in emergencies and identified alternatives; tested letters to parents versus media campaign for achieving public awareness	C and C: improved staff response to alerts (50%–83%) C and T: nurses more effective than other staff for triage call management; identified need for improvement in hospital collaborations RC: Existing STD hotline more feasible than DMV as a public health response system; response time decreased from 2 hours to 30 minutes; letters more effective than public campaigns for reaching parents of children in school	Improve preparedness system performance	Authors noted that a faster, organized response to pandemic influenza should reduce morbidity and mortality in the event of an outbreak.

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Table 1. (continued)

Study	A. QI Initiative					B. public health system performance	C. public health outcomes
	Context	Objectives	Methods for evaluation	Intervention	Findings/conclusions		
Mason (2010) ¹⁵ Study period: 2006–2009	Tacoma-Pierce County Health Department Impetus: state standards review, Multi-State Learning Collaborative	Improve documentation of race/ethnicity for reportable STDs	Monitored percentage incomplete reporting by site over time	Used Plan–Do–Check–Act: work flow analysis, examination of factors at most/least complete sites, identified barriers to reporting, provided education to address at pilot sites, expanded statewide	Specific QI approaches were successful in improving completeness of data reporting from 60% in 2007 to 80% in 2008, but dipped slightly in 2009.	Improve data quality in surveillance system	Not linked specifically to health outcomes
Mason (2010) ¹⁵ Study period: July 2006–June 2007	Two county health departments in Washington State Impetus: existing state standards process; Multi-State Learning Collaborative	Improve Chlamydia treatment rates	Monitored annual treatment rates by county and by sites within each county	Identified sites with highest rates of untreated Chlamydia infection (hospital emergency room and specific providers), developed tailored education strategies for sites	Provision of treatment for patients identified with Chlamydia in one county improved.	Improve delivery rates for needed clinical treatment: Chlamydia treatment rates increased from 87% and 94% in 2007 to 96% in 2009.	Chlamydia treatment improves health
Stanislaus County Public Health Department (2010) ²⁵ Study period: 2007–2008	Stanislaus County CA Impetus: During an assessment project, staff within the health department and the county expressed frustration about difficulty obtaining the latest data for grant applications and evaluation, and identified duplication in data collection efforts.	Improve communication and coordination of community-specific health information by redesigning an existing Data and Publications webpage	Webpage use statistics for Data and Publications page	Gathered input from internal and external stakeholders on how to address the problem; committee worked to create better public health data-sharing across stakeholder groups, and “one-stop” webpage for posting relevant data; follow-up surveys assessed satisfaction with changes, and identified need for shorter reports and “upstream” (demographic) data as well as outcomes-focused data	Increased number of unique visitors viewing the webpage per month: increased and maintained from fewer than 150 per month to 300 per month Increased the number of times data documents are downloaded by visitors: increased average document download from 31.3/month to 300–600/month (somewhat variable but consistently improved)	Improve public health functions of engaging and empowering the community, disseminating data and information	Not linked to health outcomes

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Table 1. QI initiatives in public health systems (continued)

Study	A. QI Initiative					B. public health system performance	C. public health outcomes
	Context	Objectives	Methods for evaluation	Intervention	Findings/conclusions		
Functional Category 3: Studies of administrative system improvements							
Hanover Public Health District (2004) ²⁶ Study period: 1993–1995	Hanover Public Health District, Virginia (serving four counties) Impetus: economic crisis—need to minimize costs	Improve efficiency of staffing structure	Monitoring total FTEs (55 FTE at baseline), and supervisor–staff ratio	Formation of Leadership Team, developed clear mission/vision to guide work, districtwide retreat to assess employee perception of barriers and opportunities Staff worked together to develop cross-functional responsibilities, developed partnerships with the private sector to cover functions.	Reduction in management supervisory staff by 3.5 FTE, increased “span of control” for managers from 1:5 to 1:9 FTEs	Decrease staffing costs	Not linked to health outcomes
Honoré (2004) ²⁷ Study period: 2001	Missouri State Department of Health Impetus: agency interest, federal focus on accountability	Improve performance of contracted public health service providers	Monitored contract processes; used a satisfaction survey of contract agencies at end of year	Piloted use of outcomes-based contracting (versus activity-based contracting)	Contracts not meeting early targets were terminated or renegotiated Greater accountability of funds at state level Positive response from contractors	Successfully execute contracts	Not linked specifically to health outcomes
Osceola County Health Department (2009) ²⁸ Study period: 2005–2008	Osceola County Health Department, Florida Impetus: prepare to achieve public health accreditation in 2011, NACCHO Accreditation Preparation and Quality Improvement Demonstration Sites Project funds	Identify and address common skills deficiencies among public health staff	Monitoring of individual development plans for nonsupervisory staff Evaluation of employee knowledge and skills pre- and post-training	Conducted employee self-assessments with NACCHO Operational Definition Prototype Metrics Assessment Tool, identified common training needs	41% improvement in customer service–related and 81% improvement in billing/coding–related knowledge and skills for training participants	Essential Service VIII—maintaining a competent public health workforce Indicator: LHD provides a coordinated program of continuing education for staff	Not specifically linked to health outcomes

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Table 1. (continued)

Study	A. QI Initiative			B. public health system performance			C. public health outcomes
	Context	Objectives	Methods for evaluation	Intervention	Findings/conclusions	public health system performance	
Swain (2004) ²⁹ Study period: 1997–?	City of Milwaukee WI Health Department Impetus: Unspecified agency interest	Increase the implementation and quality of staff performance reviews	Reviewed process information and qualitative feedback from participants after pilot testing	Used a “360-degree” feedback process to reflect Milwaukee HD values, and a focus on positive staff development	Qualitative feedback from pilot testers and leaders was positive. The 360- degree feedback model will be implemented at the HD using a web-based format, accompanied by a formal outcomes-based appraisal.	Improve workforce management	Not linked specifically to health outcomes

C and C, command and control; C and T, disease control and treatment; DMV, Department of Motor Vehicles; FTE, full-time equivalent; HD, health department; LHD, local health department; NACCHO, National Association of County and City Health Officials; QI, quality improvement; RC, risk communication; RWJF, Robert Wood Johnson Foundation; STD, sexually transmitted disease; WIC, U.S. Department of Agriculture’s Special Supplemental Nutrition Program for Women, Infants, and Children

Public Health District²⁶ described a collaborative effort to reorganize their staffing structure in order to reduce costs. As a result of identifying efficiencies and reducing duplication, they were able to reduce supervisory staff positions by 3.5 full-time equivalent (FTE). Honoré et al.²⁷ described a change from activity-based to outcome-based contracting processes. The authors imply that this resulted in improved service delivery because the contracts performing below expectation were terminated, and also that (continuing) contractors were more satisfied with their relationship to the funding agency.

The Osceola County Health Department²⁸ specifically worked to prepare for public health accreditation by improving activities related to Essential Public Health Service 8: maintaining a competent public health workforce. The department used an assessment to identify the most common skills deficiencies among nonsupervisory staff and addressed them through a continuing education training series. Using pre- and post-tests for the trainings, they saw improvements in customer service and billing/coding knowledge and skills among participants.

Finally, Swain et al.²⁹ reported on results of a pilot effort to improve the implementation and quality of performance reviews for staff within their health department using a 360-degree feedback model. The results from the pilot test were qualitative, and it was not clear that their pilot data were systematically collected. However, the findings were sufficient to recommend a full adoption of this change into the administrative system. None of the studies that reported on organizational and administrative practice changes attempted to link those changes to health outcomes.

Synthesis of Study Themes

Common elements or approaches reported in multiple studies were identified. Program-specific QI studies^{15,22–24} started with a “process mapping” step, or a detailed assessment of the current practice in place.²¹ This was also the first step in the study of administrative reorganization.²⁶ Authors noted that this provided the baseline against which improvements could be measured and also helped to identify points for intervention within the systems where there were opportunities to increase efficiencies^{22–24} or where a specific weakness existed.¹⁵ Four of the QI studies^{16,17,21,25} began with identification and collection of performance measures or indicators that would be used to mark improvement. Others^{15,28} used the results of systematic performance measurement to identify priority areas for intervention.

Engagement of top-level leadership was noted in a number of the studies as a key ingredient in the success of QI projects^{15,17,26} and as a barrier when not present or when leadership changed.²³ Engagement of managers,

including adding QI or program evaluation to job descriptions^{15,29} or providing individual outreach to managers,^{17,21} was similarly noted as key to successful implementation of a QI project. Almost all the studies engaged staff and/or a QI team or other advisory group to identify opportunities for improvement in processes and to help plan implementation of the QI activities.

Sometimes these teams included participants from outside the specific organization. Mason et al.¹⁵ described a partnership between internal QI teams and content experts with a state program to implement a QI project to improve treatment of Chlamydia. Lotstein et al.²⁴ partnered with hospital systems to test processes related to pandemic flu response. The Stanislaus County Public Health Department sought input from community partners to determine what health department data they wanted more access to, as well as what data they could contribute.²⁵

These studies all had an explicitly stated or implied QI question: whether a process or system improvement led to improved public health practice. However, clearly valid and reliable measures of improvement were not always provided. With one exception,¹⁶ these studies did not attempt to measure their progress versus an external comparison group. A few^{15,23} measured progress in a group receiving an intervention versus in a group not receiving an intervention. One²⁸ used pre- and post-tests. Others used internal comparisons to measure progress forward from baseline against a goal (including a process goal) or standard.^{15,21,25}

The studies identified used a variety of types of data to determine whether their practices had improved. Some studies used strictly quantitative methods to document specific service measures^{15,20,22,23,25,26} and standards.^{15,16,21,28} Some used quantitative methods to measure subjective constructs such as satisfaction.^{20,23,27} Others used process descriptions^{17–19} or subjective feedback.²⁹ Many of these studies used more than one type of data collection method.

Most of the studies did not specify limitations of their approaches outright. Boe et al.²² did include a limitations section in describing a project using quantitative data to describe improvements in WIC client management. These authors validated that their data approach was an appropriate measure by monitoring key outcome measures for sufficient time before implementing their QI effort to ensure that the measures were sufficiently stable to measure the results of their intervention. Other studies noted that subjective reports could be influenced by desirability biases (e.g., in satisfaction measures).

None of the studies in the peer-reviewed journals detailed the direct costs for projects. The NACCHO model practice database articles did report their costs: \$5,000,²⁶

\$21,600,²⁵ and \$22,500.²⁸ The minimum length of time reported for QI projects to generate recommendations was 5 months.²² The longest time reported was 10 years,¹⁶ although this period included several lengthy process steps.

Discussion

This review presents studies that described QI activities, including links to public health system performance or health outcomes. A large number of studies were found that describe “how” to do QI interventions, but few studies were found that documented the benefits and contributed to the evidence about “why” they should be done. The studies are organized in three categories, but these categories are not entirely discrete. In some published studies, the first category of organization-wide QI capacity-building projects is sometimes referred to as “Big QI,” while program-specific projects are referred to as “small qi.”³⁰ The third category of administrative QI initiatives shares elements of both, as they have organization-wide impacts but are applied to specific functions.

The vision of public health is “healthy people in healthy communities,”³¹ most often quantified using health indicators, such as the percentage of people who smoke or are obese.¹² This vision should be achieved—at least in part—by an effective public health system and health departments within the system.³² QI efforts that improve public health systems should be expected to contribute toward improved health outcomes in some way.

A small number of studies linked their QI efforts to proven predictors of health (such as WIC participation); however, most of the studies reviewed did not link directly to health outcomes or predictors of health outcomes. In some cases, outcomes were expressed as relevant to public health standards or other measures of performance. Using public health standards as the outcome to assess value of a practice change relies on two key assumptions: (1) that public health standards or performance measures are appropriate measures of higher-quality public health system performance and (2) that improved public health system performance will improve public health. In a theoretic model (Figure 1), this can be described as the logical relationship of $A \rightarrow B$ and $B \rightarrow C$. Based on the results of the current review, further study is needed to confirm these assumptions.

Interest in QI, performance measurement, and related topics is increasing, as evidenced by increasing numbers of publications. Of the 18 studies that qualified for the current review, only one was published before 2000 and nine were published in the past 3 years. As national implementation of public health accreditation pro-

vides more obvious accountability to the public and policymakers, interest and activity in QI may continue to grow.

The collection or funding of QI projects related to proven interventions, and integration of results with the continued dissemination of proven interventions, could substantially strengthen public health practice. Currently, for example, the CDC's *Community Guide to Preventive Services* (www.thecommunityguide.org) offers a synthesis of research and a list of proven public health interventions, but it does not offer detailed information about implementation (in other words, it provides lists of "what to do" but not "how to do it"). A collection of results from QI activities related to *Community Guide* interventions could be very useful.

Measures selected to describe the effective performance of public health organizations also will drive resources and effort across public health systems in this country,³³ as leaders are likely to pay attention to the measures that they know will be examined by external stakeholders or in review processes. Therefore, it is critical that public health standards and accreditation measures be carefully selected and known to be linked to improved health outcomes. If public health practice improvements lead to public health outcome improvements, then public health practice measures are an appropriate end point for studies of QI initiatives. However, Joly et al.³⁴ suggest that the selection of national public health performance standards for accreditation was not empirically driven, and additional evidence is needed to link public health standards to outcomes.

Performance measures in clinical healthcare systems (e.g., Healthcare Effectiveness Data and Information Set [HEDIS]⁶) include childhood immunization status, regular breast cancer screening, and standards met regarding specific practices for diabetes care. These HEDIS measures are all specific clinical practices demonstrated to improve the health of patients in the health plans; thus, efforts to improve the measures also will improve health.

Public health has not yet realized the same level of "face validity" linking performance measures to outcomes.³⁵ Future studies should examine associations between changing public health performance measures (including as a result of QI initiatives) and health outcomes or predictors, to bring public health performance measures closer to the proven validity of clinical performance measures. Further, in time we may be able to identify which public health standards from among a larger list have the greatest impact, as has been done for HEDIS.³⁶

Given the hypothesized interest in QI interventions as a way to manage diminishing resources, it is surprising that no studies incorporated economic evaluations

within a QI project (such as improving the cost return for programs). This concept may be embedded in some studies (such as improving efficiency of WIC client services, which should reduce the cost per client, or decreasing the number of staff supervisors), but more clearly describing and expressing such data could be helpful for communicating with policymakers as well as for prioritizing efforts for QI within public health systems.

Public health departments vary greatly in their activities and effectiveness, particularly in association with agency size, jurisdiction served, and amount of funding.³⁷ In an ecologic study, Hajat et al.³⁸ used longitudinal measures of local public health agency characteristics and performance indicators and found that changes in workforce characteristics, such as training and experience, were associated with changing performance and with the health outcome of teen pregnancy. The authors did not have information about whether QI initiatives had been implemented during intervals between measures but noted that the changing workforce characteristics they saw could reasonably have been addressed through QI initiatives. This finding lends some support to the underlying theory that public health practice, and quality initiatives, may influence health outcomes, although the authors noted that more studies should be conducted. Multiple frameworks and models for QI intervention planning and implementation were reported in the literature. One potential area for further research is to identify models that are operationalized best in public health systems or departments.

The current review was built around a conceptual model that tied QI efforts to public health system performance or health outcomes. The review may have been limited by this focus on the theoretic model and linking to outcomes; however, because there is already a great deal of documentation on the kinds of QI activities that can be implemented in the public health system, this linkage to results was an important gap in the evidence. Collection of more results-based QI initiative reports would provide motivation to participate in QI by providing evidence about the benefits, and also allow practitioners to view their own results in comparison to others'. Further, documentation of what is achieved through QI could inform ongoing development of performance benchmarks for public health practice.

Limitations

Some limitations for this study are noted. First, smaller-scale public health QI efforts that may be routine in practice may be unlikely to appear in the peer-reviewed literature. A 2008 survey of local health departments³⁹ found that 55% ($n=448$) of the health departments represented in the survey sample said they had conducted QI

efforts during the past 2 years, which suggests a much greater level of activity than what is reflected in the literature. In fact, simple process improvements may be extremely effective at improving practice but may be deemed not worth the effort by practitioners to document in a journal article, or unacceptable by a peer-reviewed journal for publication.

Fortunately, the *Journal of Public Health and Management Practice* exists for the purpose of increasing the science of public health practice, and eight of the 12 qualifying journal articles were reported there. In addition, NACCHO's *Model Practices Database* provides a review process and disseminates information about practical experiences with quality improvement, without the burden and barriers of peer-reviewed journal publication. Ensuring inclusion of specific information about results (performance or health outcomes) associated with QI interventions in both of these resources will help to quantify the value of doing QI work.

Second, the lines between “quality improvement” and “program evaluation” and “research” sometimes can be unclear. Search terms utilized for this review may have missed qualifying studies because they were not identified as such in the abstract or keywords; for example, a study that could be described as a QI project may have been characterized as “research” in publications. One descriptive study of a QI intervention (that was not included in this review)⁴⁰ described the use of QI tools for program evaluation.

In fact, the CDC Evaluation Framework⁴¹ describes steps for planning evaluation of public health interventions that are similar to themes identified in the current study: engaging stakeholders (both leaders and line staff), describing the program to be addressed, developing a clear study question, and using valid data sources to answer that question. The same steps could logically apply to research. Potentially, QI studies classified as research in the peer-reviewed literature might have provided more evidence of improvements in public health activities and their impact on performance or health outcomes. On a positive note, if learning QI processes is perceived as a barrier to implementation of QI initiatives, the commonality observed between frameworks suggests that public health leaders could instead leverage existing capacity, skills, and comfort with program evaluation activities to make QI implementation seem less intimidating.

Third, the QI interventions reviewed were all implemented in government-based state-level or large local public health departments. There was no information about the implementation of QI activities in smaller health departments, tribal health departments, or the broader public health systems inclusive of partners outside of governmental public health. Future studies should

include diverse organizations (e.g., by size, geography, population demographics, tribal systems) and improvement efforts that attempt to influence the broader public health system.

Finally, the current review focused on the peer-reviewed literature, and limited exploration of “gray literature” (such as health department websites and program reports). Many reports of QI initiatives have been documented in the gray literature, but a preliminary scan yielded articles that reported on QI activities but did not link to public health system or population health outcomes and thus would not have contributed substantially to this review. The lack of theoretic linkage between QI and public health system performance and/or health outcomes was also apparent in the peer-reviewed literature: 86% of the articles originally identified as describing QI interventions were eliminated from the current review for this reason. The finding that there is a lack of focus and evidence on the tie between public health QI and performance or health outcomes probably would not be changed by further investigation of the gray literature.

Conclusion

A small number of studies related public health QI initiatives or projects to a range of performance improvements but provided weak evidence that QI initiatives improved public health outcomes. In the future, systematic collection of public health standards scores, when combined with public health indicators and information about QI initiatives, will support better studies to “connect the dots” between QI initiatives on the one hand, and public health practice and outcomes on the other. Future studies should describe these associations in diverse public health systems. Focused collection and dissemination of QI results associated with proven public health interventions—such as those provided by the *Community Guide*—should be a goal and will assist with continued integration of QI in public health practice by quantifying the benefits of QI practices.

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