Objectives: To examine the effectiveness of an ongoing statewide public health quality improvement training program (PH QI 101) among 4 cohorts of training participants. Design: We conducted a mixed-method evaluation of the PH QI 101 training program that included measures of participants’ satisfaction, learning, behavior change, and participants’ translation and spread to their organizations what was learned. Data analysis included descriptive quantitative statistics and qualitative reviews. The Mann-Whitney U test was used to examine changes in participants’ confidence to conduct a QI project from pre- to posttraining and 6 months posttraining. Participants: Two hundred two staff members from 37 North Carolina local health departments. Intervention: An 8-month experiential learning process in which participants learn to use QI methods by applying them to a specific project. Results: More than 90% of participants reported satisfaction with the program. Median scores on perceived self-confidence to conduct a QI project significantly increased for all training waves. At least 85% of participants reported spreading QI tools to coworkers posttraining. Two-thirds of participants in 3 waves reported that the QI project conducted during the training was at the sustaining results stage. Most participants in 3 of the training waves reported initiating new QI projects at their health department following training. Facilitators to implementation included interest and support from managers and leaders. Lack of interest and competing priorities among other staff were key barriers to implementation. Conclusions: This program successfully trained 4 waves of public health professionals in QI tools and methods. Leader training and involvement was a key addition to the adapted model. This statewide approach may serve as a model to other states as they seek to achieve national accreditation standards.

KEY WORDS: accreditation, quality improvement, training

A central tenet of the Public Health Accreditation Board (PHAB) is the promotion and support of public health agency performance with the goal of improving population health. Among the priority questions in PHAB’s research agenda is one that examines the extent to which accreditation increases health department engagement in quality improvement (QI) or enhances a culture of QI. Given that the PHAB program is relatively new, the few studies that have examined this relationship have done so through the lens of QI driving accreditation participation. Some health departments are creating a QI culture that achieves and sustains performance and population improvement and were doing so in advance of participating in PHAB. Verma and Moran found that accreditation can be a driver for local health departments (LHDs) developing a QI culture. Davis and colleagues also found that among LHDs conducting informal QI activities, accreditation was the major driver for QI work. Yet, among LHDs conducting

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formal QI or creating a QI culture, accreditation did not drive but complimented these efforts. This article furthered these findings by examining the QI and accreditation relationship through the lens of a statewide QI workforce development program in North Carolina, which has a state-based mandatory accreditation program.

As of June 2014, all 85 North Carolina LHDs have participated in the North Carolina Local Health Department Accreditation (NCLHDA) program. The objectives of this legislatively mandated program are to increase the capacity, accountability, and consistency of the policies and practices of North Carolina LHDs. Accreditation benchmarks are written primarily at the capacity achievement level and include a requirement for quality assurance/QI processes with evidence of at least 2 improvements as a result of this process. On an annual basis, 10 LHDs participated in the program with reaccreditation required every 4 years. Along with other state-based accreditation and performance programs, PHAB committees used the NCLHDA standards to inform development of the national standards.

The PHAB standards provide a key opportunity for health departments to maximize QI and workforce development opportunities. The PHAB Domain 8 requires health departments to have a workforce development plan that addresses staff training needs and development of core competencies. Moreover, providing QI training to health department staff is a key strategy to creating a QI culture. Domain 9 requires health departments to have a QI plan that includes staff QI training.

As a result of QI and accreditation readiness initiatives, the number of health departments nationwide that are implementing QI projects and formalizing agency-wide QI has been steadily increasing. Yet, there is limited evidence regarding the extent to which health departments are training staff in QI. Although nearly 60% of state health departments reported providing QI training for staff on the 2010 Association of State and Territorial Health Officials profile, the majority of these health departments had trained just 1% to 25% of their staff in QI. Furthermore, on the 2012 ASTHO profile, 59% of state health departments reported having a workforce development plan; however, the extent to which specific content areas, including QI, are incorporated into these plans was not measured (Rivka Liss-Levinson, PhD, email communication, January 22, 2014). There is little evidence as to the implementation and impact of health department workforce development plans. A few states have developed comprehensive approaches to QI training. Riley and colleagues reported on the feasibility and preliminary impact of a statewide QI training program for health departments, which reached a limited number of employees at the state and local health departments. The Michigan state Department of Community Health is implementing a statewide, comprehensive QI Training Plan that it created with the Michigan Public Health Institute.

Results from studies that have examined the effectiveness of QI training among public health workers indicate that training approaches that include applied learning opportunities in addition to didactic instruction are most likely to result in improved participant knowledge, skill, and confidence to conduct QI projects as well as result in future implementation of QI projects in a health department. These studies, however, typically examine early results from training programs, such as participant satisfaction and learning, and none have examined implementation as part of a statewide workforce development effort.

The Center for Public Health Quality’s Public Health QI 101 program (PH QI 101) is a comprehensive, statewide workforce development approach to QI training and support for continuous QI among all public health professionals in North Carolina. It is designed to create a collaborative, experiential learning program to build staff expertise in using QI methods and tools while simultaneously improving the quality of their programs and services. The development of the program has been described in previous articles. In this article, we focus on the continued program implementation and examine the effectiveness of the program to train public health workers in QI principles and advance QI in health departments.

Methods

The PH QI 101 program is an 8-month experiential learning process in which participants learn to use QI methods by applying them to a specific project (see Figure 1). The training program was adapted from the North Carolina Area Health Education Center QI 101 program, which is based on the Model for Improvement. In addition, Lean QI methods were integrated into the program in partnership with the North Carolina State University Industrial Extension Service. Agency senior leaders select projects on the basis of identified gaps in efficiency and effectiveness to be addressed by teams. Leaders are encouraged to select projects that are consistent with addressing the 9 public health quality aims—efficient, effective, equitable, population centered, vigilant, proactive, health promoting, transparent, and risk reducing. The program is a combination of distance-learning webinars, 2 face-to-face workshops,
and an on-site, 4-day, expert-facilitated rapid cycle improvement event. In addition, just-in-time coaching is provided for each team to help it overcome barriers to applying the tools. Based on participant feedback and program performance measures from initial cohorts, Center for Public Health Quality (CPHQ) staff modified the program by adding calls for participants (orientation and check-in calls) and leaders, a half day face-to-face kickoff meeting, and a final follow-up call to create additional opportunities to provide coaching and ensure sustainability of QI.

Formative evaluation of the initial program implementation yielded positive results. This study evaluates the continued implementation of the program according to the 4 levels of Kirkpatrick’s model of training evaluation. Participants’ reaction to the training (level 1) was assessed through a measure of participants’ satisfaction collected through workshop evaluations.

Participants’ learning (level 2) was assessed through a measure of participants’ confidence to conduct a QI project. We measured participants’ confidence to conduct a QI project through retrospective pretest posttest design in which participants rated their perceived confidence to conduct a QI project for both pre- and post-training on the posttraining evaluation survey. Participants rated their confidence on a scale of 1 or “not at all confident” to 6 or “completely confident.”

Participants’ behavior change (level 3) was assessed through participants’ application of skills to work through achievement of QI project aims. Translating results to the organization (level 4) was assessed through participants’ sharing of QI tools with staff members in the LHD; team reports of ability to sustain QI project outcomes; and participants’ reports of initiation of new QI projects after the training period ended. The CPHQ staff also collected and summarized QI project results from each team, which included project aims and progress toward achieving results.

Measures of participants’ learning, behavior change, and organizational translation were collected through 1-month posttraining surveys and a training follow-up survey conducted 6 to 9 months following training participation. In addition to the aforementioned items, additional items examined participants’ sharing of QI methods and tools in the agency and perceived barriers and facilitators to implementing QI projects. On the training follow-up survey, participants were asked to classify the stage of completion of the QI project conducted through the training, including measuring results and sustaining results.

Survey items were pilot tested as part of the formative evaluation and as part of another QI training evaluation project. All surveys were conducted online and required multiple reminders and incentives (drawing for a gift card) to achieve a high response rate. The number of survey reminders varied from 2 to 4 to achieve a 70% or higher response rate.

Data analysis included descriptive statistics for all measures. We used a series of Mann-Whitney nonparametric U tests to examine significant differences in independent samples of median scores of participants’ confidence to conduct a QI project between pretraining, 1-month posttraining, and the 6- to 9-month follow-up survey. This article presents results on training cohorts 2 through 5 as cohort 1 results were presented in a previous article. The University of North Carolina Public Health-Nursing Institutional Review Board determined that this project did not constitute human subjects research.

Results

In this article, we present selected results from the evaluation to focus on the key outcomes from the Kirkpatrick model.

Participation

Table 1 presents the number and characteristics of the LHDs that have participated in the program by cohort. A total of 37 LHDs participated in cohorts 2 through 5 with an average of 8 staff per team. Staff roles varied by team and teams included frontline and management personnel. Population sizes that...
TABLE 1 ● Local Health Department Characteristics by Cohort

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Number of LHDs</th>
<th>Population Size</th>
<th>Percent Accredited</th>
<th>Number of Staff Registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>9</td>
<td>20,801-205,376</td>
<td>88.9</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>42,161-319,040</td>
<td>62.5</td>
<td>46</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>58,399-276,060</td>
<td>55.6</td>
<td>49</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>10,729-945,143</td>
<td>100</td>
<td>62</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>78</td>
<td>202</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: LHDs, local health departments.

these LHDs serve range from approximately 5800 to 945,000 people. The majority of these LHDs were accredited by the NCLHDA prior to or during LHD staff participation in the training. More than 200 staff registered for the training with varying completion rates because of turnover among LHD participants.

Response rates to final workshop surveys ranged from 69% to 74%. Response rates to the 1-month posttraining survey ranged from 73% to 93% and for the 6- to 9-month training follow-up survey from 57% to 68%. The average response rate for all surveys was 74%.

The lower response rates for both posttraining surveys occurred among cohort 4 participants.

Reaction

Participants’ satisfaction with the PH QI 101 training program was assessed at the final workshop. Using a rating scale from “Poor” or 1 to “Excellent” or 6, the percentage of participants who were highly satisfied with the overall course (including a score of 5 or 6) ranged from 93% to 98%.

Learning

We examined the percentage of participants who reported being “very confident” (classified as 5 or 6 on the 6-point scale) on their confidence to conduct a QI project. The percentage of participants reporting being very confident at pretraining ranged from 1% to 8%, at 1 month posttraining, the percentage ranged from 71 to 76%, and on the training follow-up survey, the percentage ranged from 44% to 71% (Figure 2). Among all cohorts, median pretraining participants’ confidence to conduct a QI project was 2. The median confidence score for all 4 cohorts at 1 month posttraining and on the follow-up survey was 5. Results of the Mann-Whitney U test to assess relationships between pretraining and 1 month posttraining scores was statistically significant ($U = 1231.5, z = -14.04, P < .001$), as were results to assess the relationship between pretraining and follow-up survey training scores ($U = 1894, z = -11.68, P < .001$). Although median scores at 1 month posttraining and follow-up surveys were the same, results of the Mann-Whitney U tests were statistically significant ($U = 7129, z = -4.04, P < .001$).

Application of skills to work

From program records, 97% of LHD teams completed their agency project. Of these, 75% completed projects with demonstrated quantitative improvements examined pre- and postproject. The majority of these projects were designed to improve LHD efficiency, such as saving time or money. Project examples include improving the fee collection rate in the wastewater treatment management program within 30 days from 30% to 50% and decreasing patients’ visit time in a family planning clinic through reduced steps within the clinic, which resulted in 14 new patient slots. An additional 4 LHDs had qualitative data to demonstrate improvements (eg, pictures to demonstrate improving inventory system or signage in the health department, etc).

Organizational change

At 1 month posttraining, 89% to 100% of participants shared QI tools with coworkers and an average of 60% shared them with 7 or more coworkers. On the training follow-up survey, 85% to 96% of participants shared QI tools with coworkers and an average of 52% shared them with 7 or more coworkers. Spread varied among
cohorts, with cohort 4 participants less likely to report sharing tools. Among the other cohorts, spread varied between 1 month and training follow-up survey measurement. On the training follow-up survey, the majority of participants in 3 of the 4 training cohorts reported that their QI project had reached the sustaining results stage (range: 65%-81%). For cohort 4, only 39% of the participants reported that they were at the sustaining results stage, but 46% were at the measuring results stage (see Table 2). On the training follow-up survey, 89% of cohort 2, 75% of cohort 3, and 73% of cohort 5 reported that new QI projects had been initiated at their LHD. Only 25% of cohort 4 participants reported that new projects had been initiated at their LHD.

**Barriers and facilitators**

On the 6- to 9-month posttraining follow-up survey, participants were asked to indicate from a list which barriers and facilitators affected implementation of their QI projects. Among all participants, the 3 barriers consistently identified as affecting project implementation were lack of interest among other staff members (40%), other activities perceived to be a higher priority at the agency (36%), and need for staff capacity building and training to conduct QI among other LHD staff (33%). A higher percentage of cohort 4 participants indicated these factors as barriers when compared with the other training cohorts. The highest percentage of participants rated the following facilitators as helping them implement their QI projects: interest from managers and leaders in QI (65%); support from managers and leaders to conduct QI (64%); and QI materials or other support provided by CPHQ (60%).

**Discussion**

The CPHQ has trained 6 training cohorts in PH QI 101 with high percentages of participants’ satisfaction, participants’ improvement in confidence to conduct QI projects, implementation and completion of QI projects, and spread of QI tools within the agency. These findings are consistent with previous studies that evaluated the effectiveness of QI training programs. The PH QI 101 program and other effective QI training programs combine didactic training with hands-on learning of QI tools and methods through a team project. The program adds activities that engage LHD leaders and use of Lean QI methods. Leader engagement has been found to be critical to QI success in other studies and was noted as a key facilitator among PH QI 101 participants. We extend this field of study by evaluating the extent to which participants were able to apply and spread what they learned in their organizations.

We attribute the success of this program to the following strategies. First, CPHQ adapted the program from 2 existing, evidence-based training programs. Second, CPHQ continuously improved the program using a quality planning key principle—successful products are designed and pilot tested on the basis of the actual needs of those who use the product rather than perceived needs. The PH QI 101 program staff used participants’ feedback loops to track and monitor participants’ reaction and make rapid adaptations as participants’ learning needs changed. For example, at program launch, many participants were skeptical of QI due to previous unsuccessful attempts at quality that relied heavily on quality assurance and used data for punitive purposes. The PH QI 101 program was revised to highlight the difference between QI and quality assurance and showcased LHD success stories using QI. This shift helped change participants’ mindset to view organizational challenges as systems issues rather than employee issues. Third, external partners, including 2 universities and the local Area Health Education Center, helped extend PH QI 101 capacity by providing expert instructional and just-in-time coaching and added diversity of expertise.

We observed decreases in most evaluation measures among cohort 4 participants. Program staff perceived that this cohort overall had lower receptivity to change, more competing priorities, and were more likely to

**TABLE 2**

**Percentage of Respondents Reporting Local Health Department QI Project Status at Training Follow-up Survey by Cohort**

<table>
<thead>
<tr>
<th>Cohort 2 (n = 26)</th>
<th>Cohort 3 (n = 26)</th>
<th>Cohort 4 (n = 26)</th>
<th>Cohort 5 (n = 41)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustaining results</td>
<td>81</td>
<td>65</td>
<td>39</td>
</tr>
<tr>
<td>Measuring results</td>
<td>11</td>
<td>19</td>
<td>46</td>
</tr>
<tr>
<td>Project has not reached measuring or sustaining results</td>
<td>8</td>
<td>16</td>
<td>15</td>
</tr>
</tbody>
</table>

Abbreviation: QI, quality improvement.
have leadership and staff turnover. Viewed through the lens of Roger’s Diffusion of Innovation Model, cohort 4 participants were more likely to exhibit change characteristics related to the late majority (skeptical, need for easy to do/hassle free, and selecting to participate on the basis of peer pressure). Also, these participants reported experiencing more barriers than previous cohorts. These challenges may have limited participant and leader time and resources devoted to the effort. Finally, several cohort 4 LHDs experienced a change in leadership or key staff during the training program, which limited support to address challenges or barriers as they implemented QI projects. We examined the extent to which the LHD size of population served had any bearing on these observations. Cohort 4 served populations of similar sizes to the other cohorts.

In addition, a lower percentage of cohort 4 LHDs was accredited or preparing for accreditation at the time of program participation. This may have been related to the LHD’s receptivity to change—if it was not ready to participate in accreditation, it may not have been ready for QI. Furthermore, we hypothesize that the LHDs that participated in the NCLHDA program had seen the benefits of conducting accountability and performance improvement efforts and were more likely to have engaged in all PH QI 101 training elements. Among those LHDs in cohort 4 that were actively participating in accreditation, they were more likely to see it as a barrier rather than a driver to participation.

Other states considering a comprehensive, statewide workforce development approach for QI or other training topics may wish to consider the following lessons learned from this evaluation and CPHQ staff observations. First, cultivate the support of leaders to invest resources in workforce capacity and culture change. In our experience, a QI training program should aim to improve workforce capacity as well as transform the organizational culture of an agency to ensure that a culture of quality that promotes performance and improves health is adopted and maintained. A “top-down” and “bottom-up” approach is necessary to ensure sustainability of QI efforts. Based on results from the formative evaluation, the program was adapted to include modules to increase leaders’ (both top and midlevel) skills to develop infrastructure to hardwire quality within the agency. This included a QI culture assessment, and early results have shown an increase in culture scores from pre- to 1 year posttraining (CPHQ, unpublished data, 2013). Based on feedback, additional support is also needed to help LHDs sustain a culture of quality. The CPHQ has developed a QI advisor training program as a follow-up to PH QI 101. Program participants learn to provide QI support within their organization, including providing QI training to other staff and assisting leaders to create QI infrastructure and culture. Future studies will evaluate the effectiveness of this program.

Second, within agencies, ensure that there is a QI champion/improvement manager who will lead a QI initiative and ensure that it is successful. Given limited time and resources, it is important to have a champion who will help continue to drive improvement and ensure that the resources are dedicated to the project. Without a champion, teams often allow competing priorities to take higher priority over QI.

Third, recruit “early adopters” to be among the first participants in a new training approach. In the case of North Carolina LHDs, many of the early adopters were already accredited when they entered the program. They will be able to lay the foundation for successful QI and their enthusiasm will help spread QI to others in the agency. The success of early adopters will also encourage other agencies to participate in the training. In the case of public health QI, these may be agencies that are already conducting QI or achieved accreditation.

We note the following limitations to these results. Collected data are primarily from the self-reported experience of participants. Response rates to evaluation surveys decreased between 1 month postraining and the follow-up survey. Participants who did not respond to evaluation surveys may have been less satisfied with and experienced poorer outcomes from the training. We noted a decrease in perceived confidence to conduct a QI program between the 1 month postraining and follow-up surveys. This may be due to skill gain attenuation or the lack of opportunity to apply the skills learned through the training. The CPHQ is addressing these challenges through the QI advisor program. These results are from 37 LHDs in one state, with a decentralized governance structure and a mandatory accreditation program. Thus, findings may not be applicable to all states. Finally, aspects of the curriculum (highly skilled facilitators/coaches) may not be available in all contexts, particularly those with limited resources.

The PH QI 101 program has maintained a high level of program quality and effectiveness, as it trained public health professionals in 49 LHDs (cohorts 1 through 6). As health departments look to meet the PHAB standards, this model may prove informative for planning and implementing workforce development and QI planning approaches on a large scale such as across a state or region. In this study, LHDs that participated in an accreditation program prior to staff participation in a QI training program reported greater translation of the QI training to the LHD. Given the myriad of accreditation promotion and QI efforts that have occurred or are underway, it may be difficult to tease out specific improvement pathways that apply to all health departments.
examine the variety of accreditation and QI pathways that lead to improved population health.29

REFERENCES