April 2020

Evaluation of an Advanced Quality Improvement Program

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Recommended Citation

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Abstract

Texas Children's Hospital implemented the Advanced Quality Improvement and Patient Safety Program (AQI) in 2009, designed to train clinicians and staff to develop leaders in quality improvement to improve patient care, lower costs, change culture, and lead improvement initiatives at the organization. Evaluations of the AQI programs measured the program's effectiveness in achieving its goals and objectives. This paper describes the Texas Children's Hospital's Advanced Quality Improvement and Patient Safety program (AQI,) the program's evaluation processes, and show the results of the evaluation of the AQI programs using evaluation surveys completed by QI participants over the span of 13 successful iterations or sessions. **Program Design:** The AQI Program grouped Texas Children's Hospital employees and Baylor College of Medicine Faculty into multidisciplinary teams to work together on their QI Projects during the 6-month duration of the AQI session. The participant teams demonstrate QI knowledge and skills gained in the course by completing a Quality Improvement (QI) project and present their results on graduation day to the senior leaders and classmates. Descriptive statistics using the survey data completed at the end of each AQI session were calculated to determine participant perceptions of the AQI session, to specifically evaluate speakers and the AQI program overall. **Results:** The data collected over the period of 7 years from 2009 to 2016 showed a total of 507 AQI graduates and 137 AQI projects completed. Participant evaluations rated the in-class training days (core class days) above average in terms of satisfaction, knowledge gained and overall relevance to the QI curriculum. Participants' pre-assessment and post assessment session evaluations showed a high percentage positive change in all the 10 domains of QI education in the AQI program. Participants rated the program very high, highlighting the areas of information needed for improvement at the current job role, and importance of the AQI program to the improvement of patient care at the hospital.

Introduction

The development of quality improvement (QI) measures started as a direct response to the need to correct errors in industry. Historically, healthcare pioneers established links between unsafe practices such as poor sanitation and its detrimental effects on health outcomes (Aravind & Chung, 2010). QI practices came into being in the mid-1920s when Walter A. Shewhart and W. Edwards Deming, both physicists, and Joseph M. Juran, an engineer, laid the groundwork for modern quality improvement in their effort to streamline production processes, while minimizing the opportunity for human error (Parry, 2014). The Joint Commission on Accreditation of Healthcare Organizations in 1987 adopted more rigorous standards, which reflected the structure-process-outcomes model that Donabedian presented in his 1966 article entitled 'Evaluating the Quality of Medical Care' (Marjoua & Bozic, 2012). The Joint Commission introduced into the accreditation process the elements of system change derived from the work of Deming, Shewhart and Juran: the role of organizational leadership, data driven decision making, measurement, statistical process control, focus on process, and commitment to continuous improvement. Further emphasis on QI in hospitals was given by the Institute of Medicine (IOM) and the National Committee for Quality Assurance (NCQA) making it essential for hospitals to adopt QI practices and train its staff in building the QI culture in the organization (Chassin & O'Kane, 2016). Many hospitals started their own QI programs to train the frontline staff in QI concepts and patient safety practices.

QI Training Programs in Healthcare Organizations

The Baylor Health Care System implemented a QI training program for leaders and other frontline staff aimed at healthcare capacity building and improving the patient safety ratings by creating a culture of safety. The Baylor Health Care system's ABC at Baylor QI program includes a 2-day overview of QI for senior leaders and 6-day core course aimed at physicians and other clinical professionals, with didactic learning and completion of a QI project (Ballard, Spreadbury, & Hopkins, 2004) (Haydar et al., 2008).

Cincinnati Children's Hospital Medical Center conducts the I^2S^2 intermediate-level training course to develop organizational leaders to do improvement, lead improvement and get results on specific projects. The program is aimed at developing improvement leaders, shifting the culture from traditional academic medical center to an improvement focus, building cross-silo relationships to create a web of leaders with system thinking, and improving clinical and non-clinical measures. (Kaminski, et al., 2012)

The Institute for Healthcare delivery research at Intermountain Healthcare in Utah developed the Advanced Training Program (ATP) in Health care delivery. The ATP is designed for healthcare professionals involved in quality improvement, outcome measurement, and management of clinical and non-clinical processes. The program is intensive and comprehensive with the goal of developing greater expertise in the field of quality improvement. The 20-day in length course trains participants in health services academic infrastructure, cost and quality control, quality improvement methodology, and specifics of

conducting clinical practice improvement projects. Participants learn how to develop and implement quality improvement initiatives in the clinical setting (Intermountain

ATP participants receive QI leadership training, and complete an improvement project. No articles have been published by the ATP on its outcomes. (Kaminski et al., 2012).

Texas Children's Hospital created an ATP course based on the content and format of the Intermountain Healthcare ATP entitled Advanced Quality Improvement and Patient Safety program (AQI). The TCH program follows the ATPs curriculum format and content to give the participants most comprehensive QI and patient safety knowledge and experience. The goal of the AQI program was to train clinicians and staff at TCH to understand quality improvement process to be able to develop and implement QI initiatives to improve patient care, lower costs, change the culture, and develop quality leaders. The course is an intermediate to advanced level QI training program for frontline staff and staff in leadership positions to improve the quality of care as a system.

Purpose Statement

The purpose of this article is to describe the Texas Children's Hospital's Advanced Quality Improvement and Patient Safety program (AQI,) the program's evaluation processes, and show the results of the evaluation of the AQI programs using evaluation surveys completed by QI participants at the end of each AQI program. Participants evaluated their learning of the AQI course content and rated their AQI experience. Descriptive statistics using the survey data completed at the end of each AQI course were calculated to determine participant perceptions of the AQI courses for speaker evaluations, course pre and post evaluation, and overall evaluation of the AQI program.

Overview of the AQI Program

AQI Course Objectives.
The objectives of AQI are to develop clinical quality improvement leaders within Texas Children's Hospital and among our community partners, improve care delivery through quality improvement and patient safety activities, and improve the culture of safety within Texas Children's and our community through education and clinical tools.

Course Design.
The design of the Texas Children's Hospital AQI program is a 6-month long session in which students attend didactic seminars presented over 7 Core class days and complete of a QI project. The AQI program uses the team approach to form QI teams within each AQI program to achieve better outcomes. Multidisciplinary team approach is linked with improved communication, limiting adverse events, improved outcomes, greater staff-patient satisfaction score (Epstein, 2014). Each participant in AQI is a member of a team that usually consisted of department colleagues who are enrolled in the program. Teams work together on their AQI Projects, develop and complete a Quality Improvement (QI) project and present their results on the graduation day to the senior leaders and other AQI participants.

Training Core class days are two eight-hour days each month for the 6-month course period. AQI offers optional pre-class workshops to teach efficient Excel skills, QI SPC charts software, and other helpful tools and templates. The core class days of the program utilize different teaching techniques, including didactic lectures, group exercises, class discussions, and application-based exercises.

Course Content.

The Intermountain Healthcare Advanced Training Program (ATP) served as a framework for the focus and curricular content of the AQI course. AQI also uses Deming's system of Profound Knowledge as a conceptual framework for the course as well as the IHI 'Model for improvement' as its core QI methodology for project completion (Langley et al., 2009).

The AQI course covers a wide range of topics including a national QI agenda, teamwork, QI and costs of initiatives, QI History and QI methods, QI data, Patient safety and communication, evidence-based medicine and consequences of implementing EMR, and leadership and QI. Table 1.0 depicts the curriculum topics presented in the AQI Course while Table 1.1 shows the 10 AQI educational domains covered by the course.

Table 1.0 Topics *in the AQI Course*

Core Class	Quality Improvement Educational Domains
DAY 1	National Quality Improvement (QI) agenda
DAY 2	Teamwork concepts, QI & Costs
DAY 3	QI History and QI methods
DAY 4	QI data and application of data
DAY 5	Patient safety concepts and communication techniques
DAY 6	Evidence based medicine and consequences of implementing
DAY 7	Leadership and QI.
DAY 8	Final Participant presentations of their projects- Graduation

Table 1.1 The *10 AQI Educational Domains*

1	Relationship between QI and cost
2	Rationale behind multidisciplinary team approach
3	components of QI and patient safety
4	application of Multidisciplinary team approach in QI
5	application of evidence in planning the QI project
6	Use of evidence-based tools in clinical practice
7	application of patient safety principles in patient care delivery
8	Use of data to quantify patient outcomes
9	identification and use of financial measures in QI
10	use of statistical process control (SPC) methods to understand

Apart from the core class content, AQI teams complete a full QI project on their unit or work area with coaching from an assigned QI expert. The participants are required to complete at least 4 PDSA cycles and show measurable change in the selected metrics. At the

end of the 6-month program, each team presents a 20-minute power point presentation to the AQI participants and faculty describing the QI initiative they developed and implemented.

Methods

Course Evaluation Strategy and Methods

The evaluation process for each 6-month AQI program are essential in helping the program administrators determine the desired program outcomes were achieved and how to improve future programs. Assessment of all course evaluation processes is used to make changes in the next AQI course. Participant evaluations help the frontline staff to smoothly conduct the program and address any barriers or concerns that may have emerged during the AQI program. Findings from a robust evaluation that show the effectiveness of the program build a successful case for continuing the program and its funding. Most importantly, the evaluation findings identify the components of program that are most useful and least useful to the participants (Allison, 2007).

Program Evaluation Processes

There are 3 areas of program evaluation that address specific aspects of the 6-month program: *Evaluation process #1, Participant Evaluation of the Speakers;* Evaluation process #2, Participant Pre and Post AQI Course Assessment; and, Evaluation process #3, Participant's Post-Graduation Summative Evaluation of the Overall AQI Program.

Evaluation process #1 is the participants' evaluation of each speaker to assess initial reaction to a specific AQI session. The AQI speaker assessment uses a 4-point rating scale to evaluate the speaker based on knowledge and expertise, choice of teaching method, applied practice, and relevance of the session to the course. The speaker session evaluations also involve a rating scale for the condition of the facilities, and an open-ended general comments section. Daily participant session evaluations show speaker trends over time and measured between different AQI sessions in a comparative analysis.

Evaluation process #2 is the AQI participants' pre and post AQI course assessment that addresses participant's perception of change in knowledge and skills after the successful completion of the course. Pre and post-test evaluations are easy to implement and effectively measure learning outcomes (Schiekirka et al., 2013). Participants complete pre and post AQI program evaluations across the 10 AQI educational domains of the 6-month course.

Evaluation process #3 is the participant's summative evaluation of the overall AQI program that is completed after graduation. The evaluation goal is to determine participant perception of overall knowledge gained from the AQI program, and how well they met the program objectives. This evaluation process helped program coordinators determine to what degree participants met the desired outcomes of the AQI and identify improvement opportunities for the AQI program.

Data analysis

Data were derived from surveys completed by the participants as a part of their AQI course regarding participant perception of course speakers, pre and post program evaluation

of the AQI course, and knowledge gain or loss from the AQI Program. Participant responses were anonymous and averages were used for data analysis.

The data collected through paper forms was entered in Excel spreadsheets and data analysis was completed using simple comparison with the previous data. The descriptive comparative analysis gave the percent change that occurred from the previous sessions and helped in modifying the program to further improve the program and its outcomes.
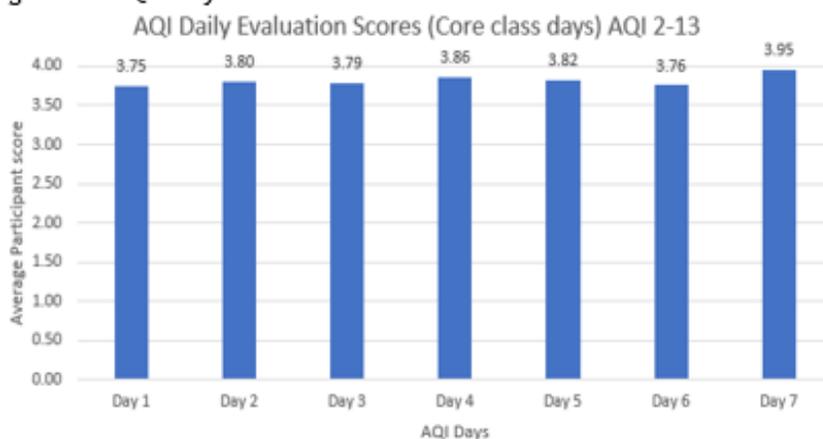
Results

Data analysis was performed on the 3 types of participant evaluations, speaker evaluation, course pre and post evaluation, and a final program evaluation. The results were analyzed based on the Kirkpatrick model that is widely used for the assessment of educational effectiveness (Praslova, 2010). The four levels of evaluation in the Kirkpatrick model are: reaction, learning, behavior, and results.

Participant Speaker Evaluations

Speaker evaluations correspond to the first level of Kirkpatrick model as they show an initial reaction to the sessions (Praslova, 2010). The results from speaker evaluations showed a positive increase over the 7-year period of time of AQI program evaluations. The results are drawn based on the scores for each core class day of the AQI session for the time period of AQI 2- AQI 13 in one set of analysis, and then according to each AQI session in other analysis sets. The figures show data from AQI 2-AQI13 because the evaluation model was not completely implemented during AQI session # 1. The participants rated the speakers on 4 characteristics: knowledge-expertise, method of teaching, application of the contents, and, overall value of the session. The 4-point rating scale used was: 1=Strongly Disagree, 2=Disagree, 3=Agree, and 4=Strongly Agree, for each question. Figure 1.1 illustrates the average day scores and Figure 1.2 shows the average score by AQI session.

Figure 1.1 AQI *Daily Evaluation Scores*

Over a 7-year period, 13 full 6-month long session AQI programs were completed. AQI sessions 7 through 13 showed higher overall speaker evaluation scores than AQI sessions 2 through 6. Participant evaluations of each AQI session from 2 through 13 showed an increase in number of positive scores. One explanation for the overall increase in session scores of AQI programs 7 through 13 may be due to continuous improvement of the program schedules and times based on the daily evaluations of the prior AQI sessions. Figure

1.2 shows a gradual increase towards AQI session #13 that may be attributed to some changes made to AQI curriculum based on the evaluation reports.

Figure 1.2 Daily Average Scores
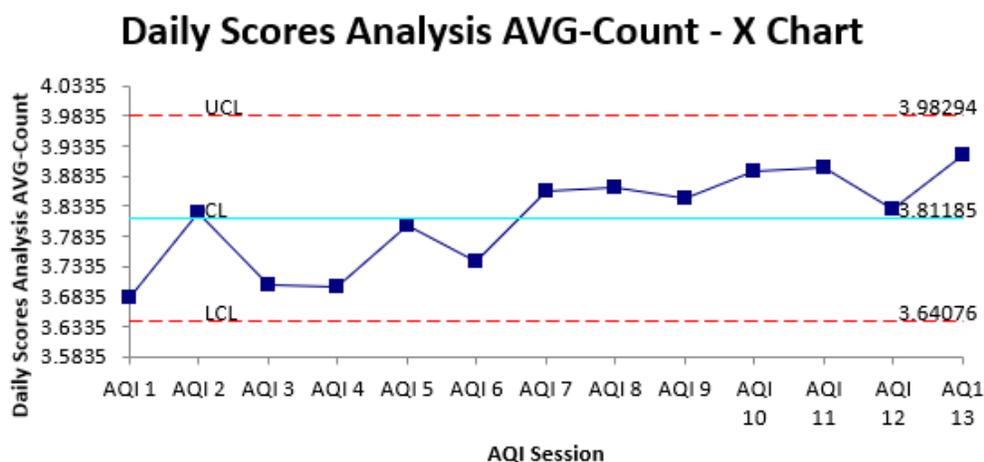
Pre-Assessment & Post-Assessment results

The pre and post assessment evaluation was introduced in the AQI evaluation structure from AQI session #2. The pre- and post-assessment results are divided into 2 categories for easier analysis based on the 10 domains evaluated in the questionnaire.

- Category 1: Conceptual learning and understanding of the QI domains (3 domains)
- Category 2: Applied learning of the QI domains (7 domains)

The first category evaluates the conceptual learning of the participants and includes the first 3 domains: concepts of quality and cost, team work concepts, and components of QI and patient safety.

Figure 2.1 *Pre and Post Percentage Change in Category 1: Conceptual Learning and Understanding (n=508)*

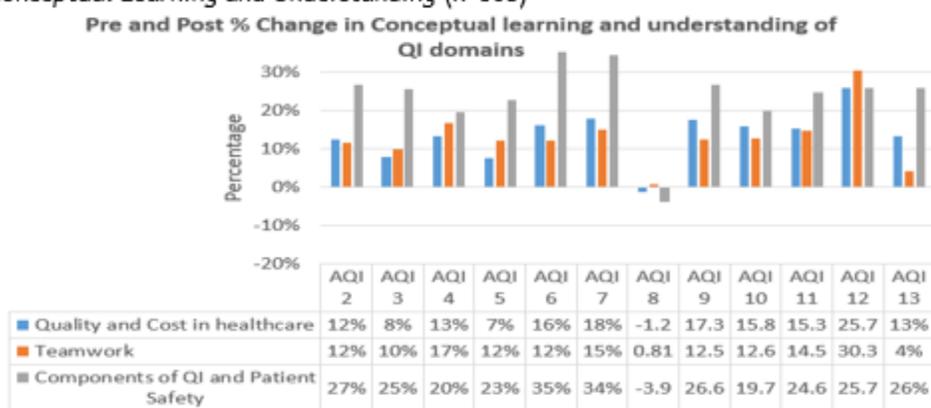|	AQI 2	AQI 3	AQI 4	AQI 5	AQI 6	AQI 7	AQI 8	AQI 9	AQI 10	AQI 11	AQI 12	AQI 13
■ Quality and Cost in healthcare	12%	8%	13%	7%	16%	18%	-1.2	17.3	15.8	15.3	25.7	13%
■ Teamwork	12%	10%	17%	12%	12%	15%	0.81	12.5	12.6	14.5	30.3	4%
■ Components of QI and Patient Safety	27%	25%	20%	23%	35%	34%	-3.9	26.6	19.7	24.6	25.7	26%

Figure 2.1 shows the first three domains of teaching evaluated from AQI 2 through AQI 13. The Pre-Assessment and post assessment results section corresponds to the learning phase of the
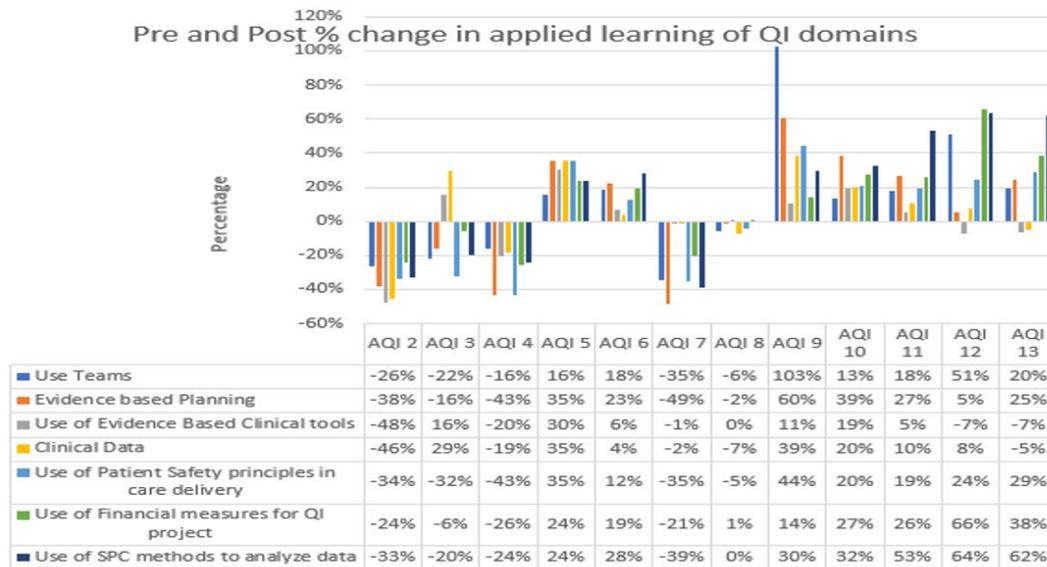
Kirkpatrick model. The positive change in the post AQI session scores, except for AQI 8, indicates that participants stated that their learning increased from the start of the session to the end in the domains of quality and cost in healthcare, teamwork, and components of QI and safety.

Evaluations of AQI 8 showed a negative percent change which is most likely attributed to a change in AQI faculty. Although AQI program faculty are largely consistent, late speaker cancellations can prompt substitute speakers and changes do occur. Nevertheless, the exact cause of the negative change in the score is not certain.

The second category evaluates the applied learning of the participants to include the remaining 7 domains: use of teams, use of evidence-based tools, evidence-based planning skills, use of clinical data for the project, use of patient safety principles in care delivery, use of control charts and other statistical process control methods to analyze data and use of financial measures.

Figure 2.2 shows the percent change in scores of pre and post assessment related to the applied learning of QI domains.

Figure 2.2 Pre and Post % change in Category-2; Applied learning of QI domains (n=508)

Pre and Post % change in applied learning of QI domains

	AQI 2	AQI 3	AQI 4	AQI 5	AQI 6	AQI 7	AQI 8	AQI 9	AQI 10	AQI 11	AQI 12	AQI 13
Use Teams	-26%	-22%	-16%	16%	18%	-35%	-6%	103%	13%	18%	51%	20%
Evidence based Planning	-38%	-16%	-43%	35%	23%	-49%	-2%	60%	39%	27%	5%	25%
Use of Evidence Based Clinical tools	-48%	16%	-20%	30%	6%	-1%	0%	11%	19%	5%	-7%	-7%
Clinical Data	-46%	29%	-19%	35%	4%	-2%	-7%	39%	20%	10%	8%	-5%
Use of Patient Safety principles in care delivery	-34%	-32%	-43%	35%	12%	-35%	-5%	44%	20%	19%	24%	29%
Use of Financial measures for QI project	-24%	-6%	-26%	24%	19%	-21%	1%	14%	27%	26%	66%	38%
Use of SPC methods to analyze data	-33%	-20%	-24%	24%	28%	-39%	0%	30%	32%	53%	64%	62%

Overall, Figure 2.3 shows that the maximum amount of percent change in the knowledge and skills of the participants occurred with the domain of components of QI and patient safety over the period of AQI 2(Spring 2010)-AQI 13(Spring 2016) sessions. The least amount of change occurred with the domain of use of evidence-based tools in clinical practice. Moreover, none of the domains showed any negative change over the period of time from AQI 2 which was in spring 2010 to AQI 13 in spring 2016 after averaging all the scores for each individual domain over each class of AQI.

Figure 2.3 AQI 2-13 Percent Change
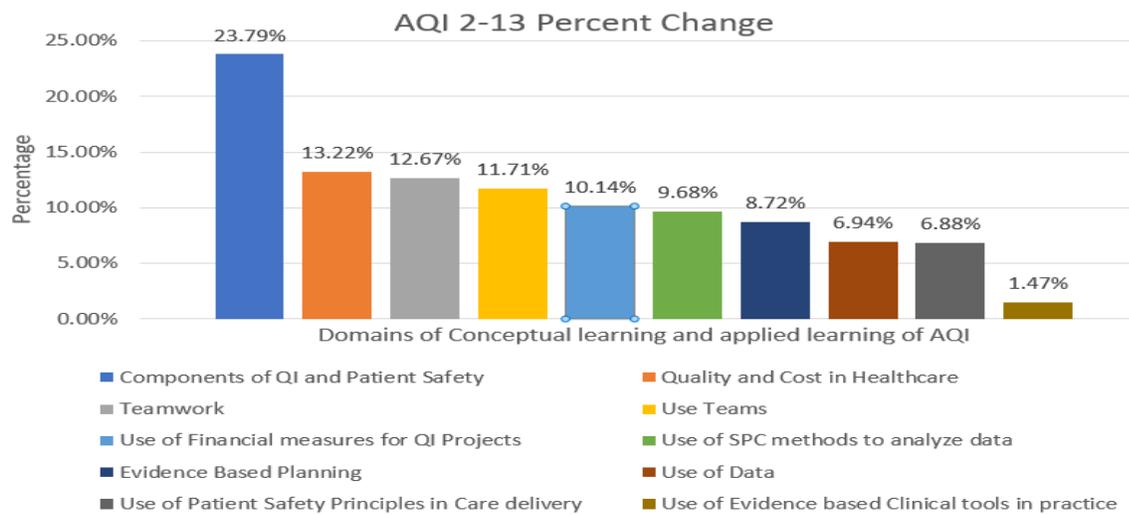
Final Program Evaluations

Figure 3.1 shows that the AQI program is aligned with the organizational goals and met its objectives over the period of time from 2009 to 2016. Moreover, it has consistently provided useful knowledge to its participants to function better in their roles at TCH. The final evaluations have shown some improvement opportunities with the involvement of AQI coaches whose job is to guide AQI teams towards completion of their projects.

Figure 3.1 Final *Program Evaluation Average* (n=508)
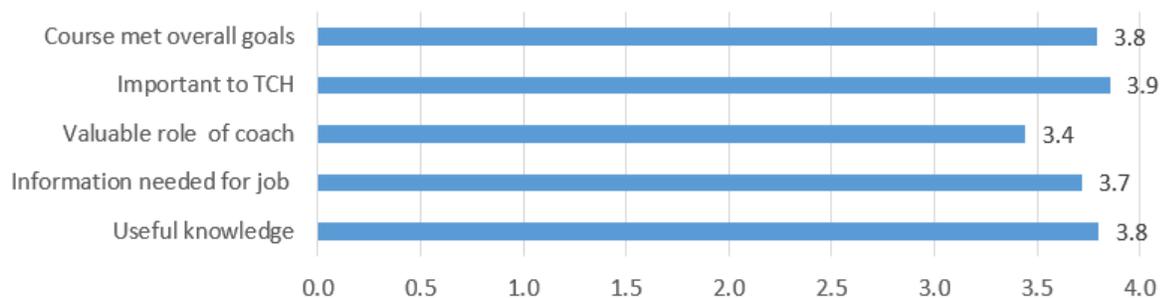
General Program metrics and demographics.

Table 1.2 shows the general numbers from AQI 1-13. Total of 137 Quality improvement projects have been completed by 508 participants in multidisciplinary teams

Table 1.2 Number *of Projects & Participants in AQI*

Total Number of Projects	137
Total Number of Participants	508

Table 1.3 Number *of Participants in Disciplines*

Discipline	Number of Participants
MD/DO	207
RNs	102
Business/Administration Staff	167
Other staff	32

Figure 4.1 shows the demographic distribution of the participants to be that 41% of the participants are physicians, 33% are business and administrative staff, followed by nurses, and other miscellaneous staff.

Figure 4.1
Demographic Distribution of the Participants
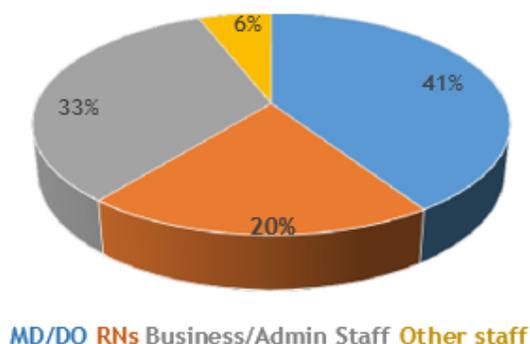
MD/DO RNs Business/Admin Staff Other staff

Table 1.4 shows the division of 137 total QI projects based on different project categories. AQI projects that had successful outcomes include, lowering C-section rates, lessening wait times and making access to care easier, lowering infection rates, and providing earlier interventions for patients, such as septic shock patients.

Although, many AQI projects impacted finances in some way, the actual cost reductions and revenue enhancement from the AQI Projects was never calculated in a consistent manner to develop a concrete financial metric around AQI.

Table 1.5 shows examples of AQI projects with baseline metrics compared to post implementation PDSA change metrics. Table 1.5 shows examples of AQI projects with baseline metrics compared to post implementation PDSA change metrics.

Table 1.4 AQI *Project Types*

Type of QI Project	Number of projects completed
Decrease in Variation of Disease/condition	21
Decrease in Variation related to screenings	7
Projects related to adherence to Clinical Standards	24
Operations improvement	23
Access	8
Reporting	4
Communication/Handoff	21
Decrease in Iatrogenic conditions	5
Patient Satisfaction/Experience	5
Miscellaneous/Other	18

Table 1.5 Examples of AQI Projects with Baseline to Outcome Comparisons

Project AIM	Baseline	Post PDSA cycles	Department/Teams Involved
Improve hygiene bundle compliance to greater than 90% by end of AQI	Baths= 86% Linen= 85% Oral care= 85%	Baths=95% Linen=95% Oral=90%	Clinical area represented by project, Health center administration
Decrease post-operative ER visits by 25% for hypospadias patients by end of 6-month period by increasing patient and family education	Average values ER visits= 2 Post Discharge Calls= 4	ER Visits= 0 Post discharge calls= 1	Department Physicians, PAs, Administrators
Increase annual depression screening rate to75% by end of 6-month period in English speaking patients with established diagnosis of Inflammatory Bowel Disease (IBD) who present for follow up care.	0% depression screening 0% social work visits	67% depression screening 100% Social worker visit	Department physicians, Nursing development specialists, Administrators

Discussion

Interpretation of the Results

Course survey results showed that participants rate the AQI course highly and state the course is consistently useful for the organization, and improves the capacity of the employees in doing their regular duties. The pre and post assessments show that participants report a considerable amount of increase in their knowledge and skills after completing AQI when evaluated across the 10 domains of quality education. Almost, all the projects demonstrated some level of measurable improvements, and over 70% of participants actually achieved the stated aim statement. REDCap is a survey software, similar to Survey Monkey, used by the hospital for survey design and dissemination of hospital wide surveys. REDCap survey was conducted for AQI alumni from AQI Session1 to AQI session13, on sustainability and it was found that approximately 30% project improvements were sustained and spread across the organization.

Survey results of the AQI programs are consistent with other similar QI programs nationally. For example, Cincinnati Children's Hospital Medical Center's I²S² intermediate-level training course reported that 85% of participant projects had measurable improvement, and 72% were completed and sustained on the unit, with many being spread to other units (Kaminski et al., 2012). Some projects based on the ABC Baylor model even suggested improvements in clinical and financial measures (Andrews & Valente, 2008).

Written comments from the AQI alumni indicate that they look at their professional work differently. Comments written in the evaluations of participants include, "AQI is transformational", "Because of AQI, I have changed the way I practice medicine", and "I wish I would have had this information in medical school."

AQI participant evaluations showed that the course is valued across disciplines and is considered important to the organization. Conducting the course in a heterogeneous cohort format over a 6-month period promotes interaction and learning, and brings about a cultural change where in which participants see Texas Children's Hospital as an interdependent system, which in turn encourages a systems level thinking and approach towards quality improvement.

Data Limitations

The collected data is based on the responses of the participants, and does not involve any kind of direct observational or impact data. Also, the response rate to the survey questions is varying from across each AQI session as well as each different kind of survey. The data analysis was done using averages of the data sets which, if the response rates are varying, can introduce false results. As not all sessions completed the 6-month and 12-month evaluations, they were not included in this report.

Future Steps

Participant evaluations from AQI have helped improve the course format and curriculum over time. Evaluation findings have reinforced the role of QI coach as an important element in completion of a QI project. Feedback from participants was instrumental in offering early workshops for participants in in basic QI tools such as QI charts, Key driver diagram, process mapping, and fishbone diagram earlier in the course to help participants better understand these tools for early project start and timely completion. The AQI curriculum introduced workshops related to data analysis and use of data display tools to provide more clarity on accessing and using patient data. Efforts were made to provide guidance on project selection and alignment with Institute of Medicine (IOM) domains and Texas Children's Hospital's QI goals.

Conclusion

The AQI course at Texas Children's Hospital has helped shift the participant's outlook to being data-driven, systems-thinking and results focused individuals. Since the inception of AQI, there has been an increased number of quality initiatives in the organization. Moreover, various units and departments are using a common language of communication through implementation of various standardized communication tools. Ultimately, AQI has been successful in breaking silos and facilitating cross-silo relationships and interprofessional communication within the organization.

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