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90-DAY PROJECT

Involving Residents in Quality Improvement:
Contrasting "Top-Down" and "Bottom-Up" Approaches

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Executive Summary

One of the recommendations in the September 2007 report of the ACGME Committee on Innovation (CI) called for identification of opportunities to enhance quality and safety in teaching settings by studying the outcomes of resident involvement in organized institutional quality improvement initiatives like the IHI's 100,000 and 5 Million Lives Campaigns. This report results from a collaborative effort involving the ACGME and the Institute for Healthcare Improvement to address this recommendation. It explores practical methods to involve residents in clinical quality improvement (QI) efforts. It contrasted institution-level quality improvement projects, such as the IHI Campaigns, and program- and resident-initiated QI projects, with a focus on how both approaches meet the dual goals of improving care and advancing residents' professional development in practice-based learning and improvement (PBLI) and systems based practice (SBP). It also analyzes advantages and drawbacks of "top-down" (institution-initiated) and "bottom-up" (resident- and program-initiated) approaches, and provides answers the question whether "top-down" approaches for involving residents in QI can overcome some of the reported limitations of "bottom-up" QI.

The report discusses what the two models of engagement in QI teach residents, finding they provide different and compatible learning opportunities. "Top-down" approaches benefit residents and institutions, with residents learning from their involvement, and bringing real-life knowledge and a fresh perspective to institutional efforts. "Bottom-up" approaches offer residents opportunities to address problems they see in their practice and to learn how to improve care. However, a reported limitation of bottom-up QI is that residents left to their own devices often are limited to a focus on residency-specific problems instead of more significant institutional issues. A key learning opportunity in "bottom-up" approaches relates to the identification of problems, and development of solutions tailored to local realities. "Top-down" approaches let residents participate in QI within a collaborative environment involving clinical and institutional leaders, and both differ from much of the traditional teaching of QI that focuses predominantly on improvement concepts. Engaging residents requires the integration of two parallel initiatives – institutional clinical improvement efforts, and teaching residents PBLI and SBP with the goals of 1) preparing them for life-long practice and 2) allowing them to assume an expanded role in QI initiatives in their programs and sponsoring institutions. The findings also suggest that larger QI goals can benefit from broad involvement of multiple professionals across disciplines and support from institutional leaders. Many efforts to involve residents in QI blur the boundaries of the two models.

Successful institutions and programs take advantage of three drivers for resident involvement in quality improvement: 1) effective curricula, role models and mentors, 2) infrastructure that imbeds QI in residents' day to day experiences, and 3) the appeal of QI to residents. These drivers help overcome challenges that included a dearth of curricula and teaching approaches to prepare residents for a role in quality management and improvement, and involving a sufficient number of residents to allow the intervention to gain momentum in the resident community, while being mindful of residents' limited time and multiple commitments. At some institutions, resident involvement in institutional QI also has been able to establish a relationship between residents and institutional leaders. This empowers residents, and gives leaders a better view of the clinical micro-systems in which residents work and learn. For "bottom-up" approaches, attending to the three drivers helps deal with the absence of links to organizational goals, and can contribute to overcoming faculty and leadership assumptions that QI is something residents do not truly need to become competent in until they have completed their clinical education. In both approaches to QI, faculty physicians active in teaching, who improve their own work, are an invaluable teaching and learning resource, giving residents exposure to QI as part of their daily experiences. In summary, the findings highlight that residents' participation in QI and enabling them to

see data showing improved care is a more powerful form of education than merely learning QI theory and processes.

The 90-day Project approach is adapted from Proctor and Gamble's Connect and Develop approach to innovation.[1] Elements include interviews with experts in health care and other fields to develop a theory about the problem and the key components of a response. This is followed by studying examples that support, refine, or revise the theory, and summarizing lessons learned.

Three Aims

In 2002 the Accreditation Council for Graduate Medical Education (ACGME) required all residency programs to incorporate six competencies (medical knowledge, patient care, communication and interpersonal skills, professionalism, practice-based learning and improvement (PBLI) and systems-based practice (SBP)) into the education and evaluation of residents.[2] The American Board of Medical Specialties uses the same competencies as the framework for its maintenance of certification (MOC) program for practicing physicians.[3] PBLI and SBP are important to efforts to improve clinical practice, but do not readily lend themselves to educational formats traditionally used in residency. Many faculty physicians currently teaching have little or no formal training in these concepts. In 1998, as part of its effort to promote quality improvement (QI) in health professions education, the Institute for Healthcare Improvement (IHI) established eight "knowledge domains" as core content for all health professions. Several of these overlap with PBLI and SBP.[4]

Active participation in QI projects is important to the professional development of the next generation of physicians. This project explored use of the IHI's 100,000 and 5 Million Lives Campaign as springboards for involving residents in QI to enhance their education and professional preparation for this important aspect of practice. The 100,000 Lives Campaign was initiated in 2004. It exceeded its target, with an estimated 115,400 to 148,800 deaths avoided by the end of the first phase in 2006.[5] The second phase, entitled the 5 Million Lives Campaign, targets a reduction of 5 million instances of harm between 2006 and 2008.[6] These efforts have engaged more than 3,000 US hospitals in improving care by adopting evidence-based interventions to reduce mortality and morbidity.[7] The six original interventions (Deployment of Rapid Response Teams; Evidence-Based Care for AMI; Prevention of Adverse Drug Events, Prevention of Central Line Infections, Prevention of Surgical Site Infections and Prevention of Ventilator-Associated Pneumonia) and five additional interventions under the 5 Million Lives Campaign (Prevent Pressure Ulcers, Prevent Harm High-Alert Medications; Reduce Surgical Complications, Reduce Methicillin-Resistant Staph Aureous (MRSA) Infection, and Deliver Evidence-Based Care for Congestive Heart Failure) are germane to the work of physicians. This suggests local efforts to change practice in keeping with the aims of the IHI Campaign may benefit from resident involvement. In addition, participation could significantly contribute to resident learning. The project has three aims:

- Assess the factors that foster resident involvement in QI and the reasons selected institutions in the IHI Campaign succeeded in involving residents in the interventions;

- Explore two models for involving resident physicians in QI that represent the range of approaches, and that co-exist in many teaching settings: institution-initiated ("top-down") and resident or residency program initiative ("bottom-up") efforts; and

- Identify drivers of resident involvement in "top-down" and "bottom-up" QI.

The idea for the project arose out of information that some teaching hospitals participating in the Campaign successfully involved resident physicians, providing them with meaningful, direct QI experience, while others did not. Engaging residents in the hospital-wide interventions under the IHI

Campaign can be termed a "top-down" approach to involving residents in QI. QI projects initiated by the residency program or individual or teams of residents represent a "bottom-up" strategy to move QI through the institution. "Top-down" and "bottom-up" approaches serve different goals. "Top-down" approaches start with an institution-level goal, develop a process to achieve the goal, and decide how to involve residents. The focus is on integrating residents' efforts into institutional goals. "Bottom-up" approaches start with a QI project identified/selected by the residents and, as needed, develop the process for engaging other organizational players.

The project used the IHI's 90-day Project method, which is adapted from Proctor and Gamble's "Connect and Develop" approach to innovation.[1] It recognized that organizational research and development (R&D) efforts can be bolstered by collaborations and alliances that seek to better understand market criteria. It found that small entrepreneurial companies and large organizations truly seeking to be innovative were exploring a new approach of "open innovation," broadly leveraging innovation assets (including those of competitors). This required both changes in philosophy and practice around product innovation, but offered the organization access to a larger cadre of creative and problem-solving talent, with a "permeable boundary" between in-house and external R&D experts. Important elements of the IHI's adaptation of this approach to health care include interviews with experts in health care and other fields that are developed theories about the problem, along with suggestions for how to address it. The primary outcome is a summary of the lessons learned, with a focus on the implications for future learning and changes in practice.

Literature Review

Aron and Headrick recommended a systematic approach to enhance quality and safety in health professions education, including changes in curricula and organizational culture, and assessing outcomes at the individual and program level.[8] The literature on approaches to teaching PBLI and SBP and related QI concepts focuses on three areas: 1) didactic methods (lectures, case studies and journal club); 2) quality improvement electives; and 3) resident-initiated QI projects. Several articles also discussed the benefits of involving residents in QI, and the challenges posed by time limits, rotations as the means of organizing educational experiences, and other attributes of residency programs. A systematic review of the literature on teaching PBLI found 40% of the articles discussed experiential learning of QI, and studies predominantly assessed educational outcomes.[9] Approaches for applied teaching of quality improvement involves incorporating QI principles and concepts into current clinical events such as morbidity and mortality (M&M), morning report and clinical case conferences efforts.[10,11,12,13,14] Recent efforts have focused on integration between didactics and applied approaches to teaching PBLI and SBP, with a particular focus on quality and safety.[15,16,17,18,19]

Quality Improvement Electives and Projects: The literature on the use of QI electives includes descriptions of month-long PBLI or QI electives,[20,21] with some using a multi-specialty approach.[22] One study found that residents who completed the elective scored higher on QI knowledge and application with this knowledge remaining at retest 6 months later.[4] Studies of resident participation in QI often describe small, focused projects that can be undertaken within the constraints of residents' rotation schedules and available time, or that relate to longitudinal ambulatory care experiences, such as use of "report cards" on their use of quality markers related to diabetes care.[23] Several institutions developed QI projects in which residents designed, implemented and evaluated a quality intervention or a clinical guideline.[24,25,26] Another approach entails use of a matrix that links the 2001 Institute of Medicine (IOM) six aims with the ACGME competencies, used for QI teaching sessions and to explore institutional quality problems and clinical events.[19]

Descriptions of efforts to involve residents in a larger department or institutional ("top-down") QI effort still are rare, and the literature largely has not addressed the benefits of this involvement to residents'

learning and/or patient care. The limited number of examples in this area include a project to solicit resident input in addressing waiting times in pediatric urgent care;[27] use of clinical practice data to enhance immunizations practice in a pediatrics clinic;[28] improvements in obstetrics care that resulted in reduced length of stay and improved patient outcomes;[29] and use of standard order sets to improve outcomes for patients with community-acquired pneumonia.[30] A larger number of articles have addressed quality concerns particularly germane to teaching settings, such as use of electronic or paper-based data summaries to support the information exchange during the hand-off.[31,32,33,34]

Institutional Initiatives and Collaborations in Involving Teaching Hospitals: A small but growing body of literature describes QI collaborations in teaching settings, including interventions to reduce bloodstream catheter infections and other elements of the IHI Campaign,[35,36,37,38] and efforts to link clinical quality and improvement education for physicians and other health professionals.[39,40,41,42] Collaborations focused on sharing data and best practices to achieve quality improvement, with positive outcomes for care for patients with cardiovascular disease,[43] premature infants,[44] patients with chronic disease,[45] and prevention of adverse events,[46] though none emphasized resident education as a key aim. Other projects focused on communication between ICU residents and nursing staff, resulting in an enhanced understanding of the daily goals for care and a reduction in length of stay.[47] Several articles commented that expanding this work to a larger number of institutions could have a profound effect on QI learning and practice in teaching settings. In addition, the Academic Chronic Care Collaborative and the Academic Rapid Response Collaborative adapted established QI approaches to teaching settings and emphasize involvement of residents.[48]

Challenges: A few studies noted that residents are good at identifying quality problems, but generally are not able to take on sustained and complex QI action, and that enhanced resident peer leadership and faculty engagement are needed to overcome these limitations of resident-initiated QI.[49] An added challenge may be the occasionally problematic perception of QI in academic institutions. A study of the use of total quality management (TQM) in emergency departments found it was perceived to be least effective in university settings, with 85% of these rating their TQM programs as having little or no effect.[50] Another found QI projects in health care to be predominantly managerially oriented, rather than emphasizing medical/clinical aspects.[51] Overcoming these challenges requires enabling resident participation on interdisciplinary QI teams, integrating QI information into existing conferences and educational activities, use of case-based instructional approaches that address QI principles, and use of data for QI role-modeled by clinicians with real experience, and institutional leaders acknowledging and celebrating QI as a necessary competency for all physicians.[52]

Benefits to Resident Learning and Practice: Studies consistently found that involvement in QI benefitted residents' PBLI competence, including skill in designing projects and conducting plan-do-study-act cycles and their self-ratings of knowledge and efficacy related to QI.[5,53,54] Residents rated QI activities as enhancing their proficiency in PBLI and SBP; these included quality assessment-systems improvement exercises (rated by 92.9% of respondents), multidisciplinary rounds (92.1%), morbidity and mortality morning conferences reports (86.8%), clinic chart self-audits (76.4%), and nursing evaluations (52.8%).[55]

Limitations of the literature include the small sample size of many studies (often no more than 15 to 20 residents), the narrow scope of many resident-initiated interventions, and the fact that outcomes often are limited to the effect on residents' knowledge and attitude, contrasted with opportunities to engage in clinical QI activities or see the outcomes of these interventions. The literature also contained few articles on making QI data available to residents and the effects of this on resident learning and practice. One article described clinical repositories to allow residents to compare data on their patients to relevant performance benchmarks, which the residents in this study found useful.[56]

Two Models: "Top-Down" vs. "Bottom Up"

A key aim of this project was to explore the strengths and weaknesses of top-down and "bottom-up" approaches for involving residents in QI, including whether "top-down" approaches could overcome some of the limitations of QI projects initiated by the residency program or the individual resident. It also explored what both approaches teach residents. "Top-down" approaches are initiated by the entire institution, with interventions selected at the institutional level, with engagement of a range of professionals to meet institutional QI goals. They may be initiated by a single institution, or done as a collaborative effort involving multiple institutions, like the IHI Campaign. The scale and scope of the Campaign makes them an important vehicle for involving large numbers of residents in QI, allowing them to learn PBLI and SBP. In contrast, "bottom-up" approaches begin when a resident, a team of residents or a program identifies a particular quality problem in the inpatient or ambulatory setting. Residents and/or their program leaders are the major drivers of change and often the sole participants in the QI effort. Residents' QI electives generally do not allow for the completion of larger projects that require collaboration and participation from other health professionals. Limits on resident hours, and residents' multiple additional obligations further constrain the feasibility of resident- or program-initiated projects to address major QI problems, and with this the opportunity for residents to see the benefits of the efforts. Many "bottom-up" projects have residents working alone, when much of the clinical improvement work in the practice setting is done in teams.

Methods

The project used purposive sampling of participants with "top-down" approaches; representatives from institutions that had made major gains in introducing residents to QI, which included a mix of "top-down" and "bottom-up" approaches; and experts on quality management and improvement. Resident engagement in QI under "top-down" approaches was explored through interviews with six teaching hospitals that involved residents in the interventions and served as mentor hospitals for the Campaign. Institutions in the sample included a mix of university and independent teaching hospitals, were geographically diverse and had implemented different QI interventions within the IHI Campaign.

Data collection: Interviews were conducted over the telephone. A list of the individuals interviewed is provided as *Attachment 1*. The researcher used a consistent set of broad, open-ended questions to encourage institutional representatives and experts to share their experiences and perspectives on resident involvement in QI. The questions were derived from the literature on residents' involvement in QI, and the initial list was refined in conversations with experts in quality management. As needed during the interviews, additional, focused questions clarified information, explored subtopics in more depth, and directed participants to other important aspects of resident involvement in QI.

Descriptions of hospitals' interventions as part of the IHI Campaigns were augmented by interviews with the representatives, who offered in-depth information about the characteristics of resident involvement, and the effect on resident competency in clinical care, PBLI and SBP. The interviews explored resident participation in the roll-out and management of the intervention, and the aspects of the Campaign that facilitated or hampered resident involvement. Study of program- and resident-initiated ("bottom-up") and mixed QI efforts entailed interviews with several institutions and QI experts. Interviews lasted from 35 to 75 minutes, with field notes taken. Individuals volunteered to participate in the interviewed and were informed that the information from their interviews would be aggregated and de-identified.

Data aggregation and analysis: Transcripts from the interviews were de-identified and entered into QSR NVIVO, a software system for managing qualitative research data.[57,58] De-identification ensured that information on barriers to resident involvement in QI and other potentially sensitive information

could be reported without concerns for interviewees and institutions. The data were analyzed using a grounded theory framework to develop theory from qualitative information, using inductive and deductive thinking. This involves constant comparison of data in an iterative process, with the goal of discovering ideas and concepts.[59]

Description of QI in Institutions with "Top-Down" Approaches

Northwestern Memorial Hospital made significant gains in the care of acute myocardial infarction, protocols to reduce blood stream infections, use of ventilator bundles, and ensuring the appropriate delivery of prophylactic antibiotics. This allowed residents to appreciate the QI benefits of participation in the Campaign, and allowed them to be part of clinical teams that provided a high level of care. The hospital provided residents with data relevant to their involvement in QI and made it possible for them to do studies and publish on QI initiatives. The institution encouraged residents to be advocates for institutional change, with a particular benefit being the alignment of systems-based practice learning goals with organizational QI goals. *Harborview Medical Center* created an SBAR tool with clinical triggers for calling the rapid response team, with all members of the health care team, including residents, on-call for rapid response team support during a pre-code situation. The institution is developing metrics to assess the effect of rapid response teams on cardiac and respiratory codes. *Henry Ford Hospital* implemented interventions to reduce blood stream catheter infection rates, using a simulation-based training program for medical staff, a collaborative approach to reduce surgical infection rates, and use of ventilator bundles. In 2007, the hospital started to monitor multiple dimensions of harm (mortality, infections, falls, surgical complications), tracking these measures locally and at the system level with comparison to other institutions. Efforts focus on 1) disclosure of errors and patient and caregiver support; and 2) assessment of physician and staff safety culture, emphasizing "just culture," speaking out and improving team communications.

Franklin Square Hospital rolled out the rapid response team hospital wide after just four planning meetings. Training uses educators and ICU staff nurses with positive feedback and immediate buy-in, and participation in the Campaign is reinforced through Town Hall Meetings and celebrations. *Cincinnati Children's Hospital Medical Center* instituted rapid response teams, which resulted in a reduction of instances where patiens were resuscitated outside the ICUs from .27 to .11 per 1,000 patient days. Current efforts focus on enhancing the ability of staff to identify when children are getting worse. The hospital performs house-wide surveillance of central lines and improved line insertion practices with a special focus on line care for high-risk populations in its hematology-oncology and bone marrow transplant units and the neonatal ICU, resulting in reduced infection rates. The hospital's efforts to reduce serious safety events, including codes outside the ICU, ventilator-associated, catheter and surgical site infections and adverse drug events achieved 80% reduction over the baseline prior to participation in the Campaign. *Berkshire Medical Center* implemented a nurse-activated rapid response team, resulting in a significant reduction in code blue calls. *Dartmouth-Hitchcock Medical Center's* Leadership Preventive Medicine Residency combines resident education in an accredited core specialty with a preventive medicine residency. Residents complete a project to improve processes or outcomes of care for a population of patients. The institution offers a month-long QI elective for residents in several programs that expose them to experts to deepen their understanding of theory, concepts and tools. Due to the one-month constraint projects often are small and time-limited and success is defined as residents effectively diagnosing system problems. In addition to participating in the 5 Million Lives Campaign, efforts at *HealthPartners in Bloomington, MN,* have focused on increasing residents' day-to-day exposure to QI. A retreat explored how residency programs and residents could be more involved with the Campaign to achieve its goals and enhance resident education. The institution also plans to provide residents with more data, including data on patient satisfaction and functional improvement, as is already done for clinical departments and faculty physicians. *Virginia Mason Hospital, Seattle* has program-initiated QI efforts with strong institutional support and an emphasis on lean production.

Residents are encouraged to be part of QI teams and are sought after for their systems knowledge and fresh perspective. For many projects, the agenda is generated by the residents. Examples include improvements in the residents' cardiology experience, scheduling in the continuity clinics, and marking the experience of patients receiving care from residents more "high-touch."

The *Academic Chronic Care and Rapid Response Team Collaboratives*, initiated by the Association of American Medical Colleges, use the IHI's Breakthrough Series Collaborative Model to improve resident education in how to deliver high quality care for individuals with chronic conditions. Resident and faculty comments across the collaborations offer evidence of a maturation of the QI concepts, with the time from exploratory project to local level institutionalization taking as much as two years. They highlighted the importance of access to local data and incorporating data management into the electronic medical record and other resources that allow real-time data collection. Key learning included the need to break down traditional silo and hierarchical structures, and enhancing residents' understanding of the benefits of a multidisciplinary approach. These collaborative efforts also emphasized aligning residents' role to their level, including their understanding of the QI process.

Themes: Shared Attributes and Mixed Models

Several common themes emerged from the teaching hospitals represented in the interviews. In all models, factors important in success include:

- Having faculty supportive of the project(s);

- Having residents learn about QI as part of their formation;

- Having the time and settings to increase resident knowledge of and excitement about QI; and

- Overcoming resident and faculty assumptions that QI is separate from the practice of medicine, and belongs functionally and culturally into organization's "administrative silos."

Common attributes across "top-down" and "bottom-up" and mixed models are the need to define a clear process for QI, including the use of regular, small tests of change. In addition, to be ultimately successful, both types of QI efforts need financial and "moral" support from the institution's clinical and educational leadership.

The six teaching hospitals participating in the IHI Campaign noted that some QI efforts are so large they can only be implemented with a "top-down" approach. In addition to the IHI Campaign, all six had other ongoing efforts to involve residents in QI. Some predated the Campaign, and continued in parallel with it. Topics for program- and resident-initiated QI included infection control, care protocols for specific patient populations, and improving communications and patient hand-offs. Institutional leaders noted the level of resident engagement in QI increased in response to the "top-down" approach under the IHI Campaign, though the extent to which they engaged residents in interventions varied. All six provided education to residents to ensure they understood their role in the intervention. Some adapted their approach to residents' status as learners, such as adding simulation training to improve residents' performance in line insertions.

The structure of resident involvement in "top-down" models was similar across organizations. Institutions sought resident input in the implementation process, by involving senior and chief residents or "delegates" with an interest in QI in the roll-out, with these representatives at minimum helping to design the communications and education strategies for residents. For institutional leaders, the value of residents' involvement in "top-down" interventions is that it exposes them to systems of care they want to be part of for the remainder of their career, and lets them better understand and help build these systems. For many, this represented an organizational context for QI that is different from program-

focused efforts to teach and apply PBLI and SBP. A shared attribute of "top-down" approaches is that they promote collaboration between residents and other health professionals.

Another advantage of "top-down" approaches is they allow going beyond current perceived constraints on resident time and scope of a project that can be done involving residents, and they also provide opportunities for residents to work in teams with other professionals and institutional groups. Respondents emphasized that resident involvement cannot occur as an add-on – it must be an integral part of their clinical work, favoring a "top-down" approach. How the effort involves residents is important to the success or failure of the intervention. Respondents noted they had made errors in how they involved residents, which ultimately generated knowledge to refine their approach. At one institution, six revisions were required to find a workable process for involving residents in a "top-down" effort. Another held a retreat for all residency programs to assess the status of involvement and explore ways for residents to become more involved in achieving the Campaign's goals. All respondents noted that, when done well, "top-down" approaches allow residents to learn collaboration on teams, within a larger collaborative effort involving the institution's clinical and educational leaders.

Respondents from "bottom-up" and mixed models felt that the most important benefit of resident engagement is that it lets residents identify and act on opportunities for improvement. Key factors in the success of "bottom-up" initiatives were 1) projects that interested residents, addressing quality problems they saw in their patient care environment; and 2) projects that fell within the scope of the resident(s) or the program to have a positive effect. A drawback of "bottom-up" approaches is that they may not give residents as much insight into the larger systems of care or provide an opportunity for learning about institutional change processes. In addition, their dual role as learners and practitioners may cause them to be viewed as participants, but not as leaders or drivers of change.

Dealing with Challenges

> "When programs involve residents in QI, institutional and clinical leaders may ask why turn
> the keys over to individuals not fully trained and without extensive education in QI." –
> *Faculty representative from an institution with a "top-down approach*

Institutions and experts reported that meaningful resident engagement in QI requires disbanding current, tested recipes for resident exposure to this area, which emphasize keeping engagements short, avoiding overreaching in terms of goals, and seeking to affect primarily residents' knowledge and attitudes about QI. Irrespective of the model used, all institutions with gains in resident involvement in QI had experienced and wholly or partially dealt with a range of challenges. These included challenges commonly associated with organizational change, including fiscal constraints, and the need for institutional champions and commitment to changes that promote better care and education. For "top-down" approaches, this meant finding the right balance of involving sufficient residents to allow the intervention to gain momentum in the resident community, while being mindful of residents' limited time and multiple other commitments. Successful to-down efforts also overcame the initial and refresher education needs arising out of their rotation assignments and short tenure in a given clinical area. An ongoing challenge for all institutions and programs was the dearth of clinical champions who can integrate QI into the daily lives of residents. In addition a number of challenges related to the particular QI interventions or to attributes of teaching settings.

"Top-Down" vs. "Bottom-up" Approaches: Challenges of "top-down" approaches include residents not initially involved in selecting the intervention. An effect could be that its saliency to residents' practice may not be immediately apparent. Residents also may only be minimally involved in the institutional planning and implementation process. An important part of any effort to involve residents in QI is making sure residents know their role in QI, both in the immediate work related to the

Campaign interventions at the given institution, and as a way to teach them more broadly about QI. A challenge of involving residents in planning and implementing QI is that many different perspectives and interests need to be integrated and reconciled with the goals and scope of the intervention, and that resident involvement needs to be sensitive of residents' educational needs related to QI. Respondents noted these challenges can be overcome by careful attention and planning by clinical and residency program leaders.

Structural Challenges: The current education and rotation framework is a challenge, due to month-long rotations and the model for engagement in a clinical area, and residents missing meetings because of schedules and other duties. Time constraints, made more pronounced by the resident duty hour limits, mean residents are available fewer hours and are busier during these hours. This poses constraints on to how to educate residents about the initiative and facilitate meaningful engagement. Programs overcame this challenge by limiting administrative work related to the QI effort and providing role models and mentors. Many limited primary involvement to a few residents, who represented peers on committees and project teams. The critical link in this model is how to maintain contact between them and their peers who need information about the initiatives and exposure to QI concepts and practical applications. Some institutions with "top-down" approaches initially did not create dedicated education for residents (that also were sensitive to their rotation schedules and time constraints). These institutions reported that their efforts fell short of expectations until they instituted resident-specific education and outreach programs. Informing residents via e-mail or printed documents also was not found effective – institutions reported that it was not clear whether information was read or understood, and the medium lacked interactive capability. Some used on-line programs, with interactive functions and the capability to track access, and reported mixed but generally positive experiences. Most institutions used multiple strategies for educating residents, and all worked extensively with senior and chief residents as representatives for the resident community. Residents also need frequent and intensive reminders and refreshers about the Campaign's objectives and the changes in practice necessary, in large part resulting from to the rotational nature of their assignment. Introducing new cohorts to the IHI Campaign and other QI practices as they rotate through clinical settings make involving residents more time consuming that involving other members of the health care team. The rotation models may make residents feel less invested in the QI efforts in the given clinical unit and less willing to adopt changes in their practice this requires.

In addition, how interventions are structured may reduce resident opportunities for engagement in patient care. At an academic medical center not included in the study, implementation of rapid response teams resulted in reduced learning opportunities for residents, because they were not involved in the rapid response teams, and the effort resulted in fewer cardiac arrests requiring response by the code team that included residents. In contrast, another institution overcame concerns about rapid response teams interfering with the medical education. Residents now appreciate having extra resources available to watch over the high-acuity patients, which allows them to take active action without over-burdening them or the responsible nurses.

Compatibility with Education and Academic Frameworks: The goal is productive and educationally valuable QI engagement to benefit resident learning and the institution's QI aims. Educational and quality leaders may have different ideas about how to integrate QI into residents' curricula and work life, arising from differences in the culture of academic settings and the culture of institutional QI. An extreme form is the thinking that clinical departments care for patients, teach and conduct research, rather than improve quality, with QI seen as remote from this and within the "administrative" domain. A related matter is academic autonomy and control, evidenced by comments that suggest "bottom-up" QI is preferable because it constitutes "research," making it easier to find resident and/or faculty champions. Some faculty members (and residents) are hesitant to embrace QI, because it means giving

up individualistic approaches to practice, subjecting themselves to peer judgment, and partnering with institutional leaders, all perceived as losses of autonomy. Institutional leaders may inadvertently damage resident and faculty engagement by using QI to advance administrative agendas perceived as encroaching on clinical prerogatives. Administrators may view projects from a cost perspective, while residents (and faculty) may see them from a horizon of improvement affecting decades of future practice. These disconnects can be overcome by capitalizing on a common vision that includes the imagination of young physicians, and educating residents about financial constraints. When the latter is not done, it may make residents seem naïve, which reduces the power and value of their creativity and context knowledge.

Prior studies have focused on faculty reluctance to change, but this reluctance can extend to residents. When they begin their training, they have carefully selected the "ideal" place for their education, and many expect that nothing will change through graduation. This may make them passive and conservative, when they could have a significant positive influence on the environment in which they practice and learn. Residents also may perceive that interventions are not within the scope of their practice. An initial challenge at one institution participating in the Campaign involved convincing residents about their role in preventing MSRA infection and that the day-to-day changes required (hand washing and donning gowns and gloves) were part of residents' responsibilities (not that of nurses or other providers) and that they also constituted a critical element of their learning.

Success as a Barrier to Resident Involvement: The success of efforts to enhance clinical quality and safety can have a chilling effect on resident involvement. A hospital with a multi-year, substantial, widely deployed and nationally recognized institutional QI effort reported that the extent to which other providers had become expert in QI and the highly developed nature of the interventions made it much more difficult to bring the residents along, given their short-time exposure in a given clinical setting. In contrast, a danger of meaningful resident engagement and excitement in "bottom-up" and mixed QI models, is many residents wishing to be involved, with multitude of projects, goals and priorities for improvement. Institutions may not be able to take on all of them, with the potential for residents to become disengaged as their suggestions are not implemented. Overcoming this requires faculty and institutional mentors who can assess projects and assist residents in selecting those with the greatest likelihood of success, the greatest benefit to patient care, and the most ability to engage and hold residents' interest.

Data Availability and Delayed Feedback: All respondents emphasized that resident involvement in QI significantly benefits from available, easy to query data to help in assess the problem, design the project and see its benefits. Residents are more engaged when provided with data relevant to their personal practice. The current relatively limited availability of relevant data thus is a major challenge, especially for "bottom-up" approaches. A major community teaching hospital in the study sought to initiate QI projects with a resident focus, yet only one area – improving patient hand-offs – to date has resulted in an intervention. Availability of data was cited as the major barrier, and the institution now works to link hospital data with resident projects to allow generation of data pertinent to residents' QI activities. Lack of data appears to be less of a concern for "top-down" approaches.

When data is available, aggregation and manipulation to produce meaningful summaries can be a challenge, particularly when the QI effort is not initiated at the institutional level. A few institutions responded to this challenge by assigning data analysts to assist resident teams engaged in "bottom-up" or mixed approaches. Another challenge is the time lag until the outcomes of QI interventions become apparent. One advantage of the American Board of Internal Medicine's Practice Improvement Modules (PIMs) is that results become apparent relatively quickly. A manifestation of delayed feedback from an

educational perspective is that the long-term effect of resident involvement in QI on their professional development and preparation for practice are difficult to assess.

Benefits to Residents' Learning and Practice

> "The program directors asked resident to assess the percentage of patients in their diabetes clinic who were under good control. The HgbA1c values for patients showed a lack of control. At that point, the residents became more involved in QI." – *Resident participant in the Academic Collaborative*

Institutions seeking to bring QI into residents' daily experience reported they had made progress in clinical areas, but noted there was room for improvement in the development of educational modules and delivery mechanisms that allow QI to become an integral part of the residency curriculum. It entails retaining and modifying some current models of resident exposure, such as attending "good" institutional QI meetings, involving residents in root cause analyses and other QI team efforts. For the residents, *active participation* in QI and seeing the benefits in the form of improved care is a more powerful form of education than hearing lectures. Engagement in QI initiatives changes how residents learn and allows them to be advocates for institutional change. Most respondents felt their effort could achieve added gains from an educational perspective, with QI becoming an integral part of the residency curriculum. Promoting successful resident engagement in QI requires integration of two parallel efforts– institutional clinical improvement efforts and teaching of PBLI and SBP. Resident engagement in QI must be an integral part of residents' clinical work and learning experience, and must take advantage of local contexts (institution, program or clinical micro-system), adapt curricula to these contexts to allow resident immersion in QI theory and methods, and allow application of residents' new learning to the local context to allow them to function as catalysts for change.
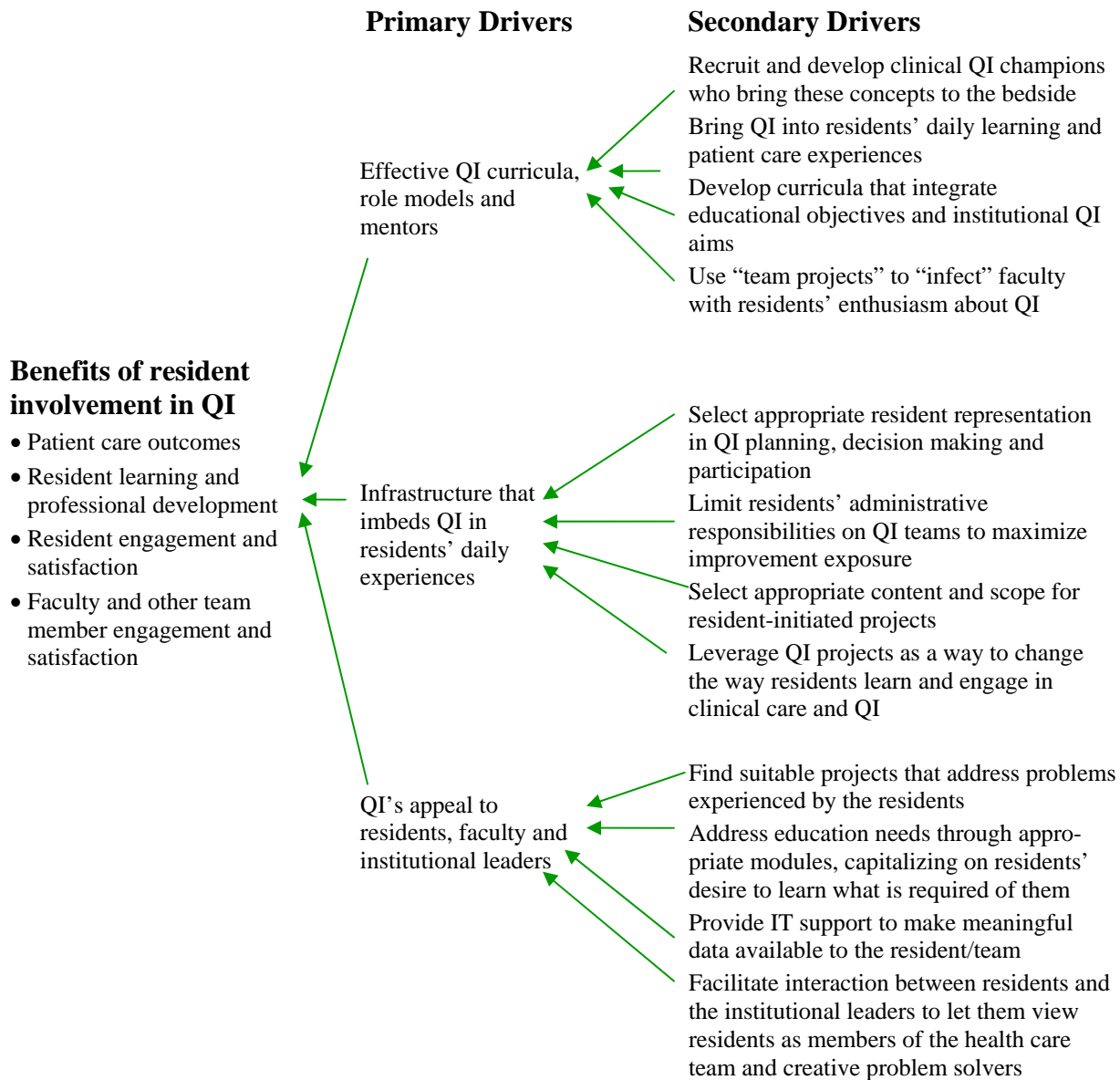
The two approaches are compatible, and teach residents different messages about their engagement in QI. A key learning outcome in "bottom-up" approaches is the identification of problems, and the development of solutions that are tailored to local realities. A critical educational benefit of "top-down" approaches is that they allow residents to participate in QI efforts done as a team process and within a larger collaborative environment that involves clinical and institutional representatives. Residents' comments in institutions and programs that made a commitment to clinical QI highlight their changed perception of the education-clinical interface. One chief resident's perspective was that "resident participation is meaningless unless we do a better job of teaching." Comments indicated that participation in institutional (and to a lesser extent project-based) QI efforts made residents feel more fulfilled with their education and practice. When it comes to mechanism for providing feedback to residents on their engagement in the Campaign, institutions reported being in the contemplative or early development stage. Respondents emphasized the need for feedback to go beyond traditional resident evaluation. For "top-down" initiatives, the individuals that traditionally evaluate residents in PBLI may not be those with the knowledge of a resident's engagement in the institution's QI effort, and programs with "bottom-up" QI reported that the nature of these projects made it easier to isolate and evaluate residents' contribution. All institutions are improving their feedback mechanisms.

New Thinking: Practical Approaches to Enhancing Resident Engagement in QI

Three Primary Drivers: The interviews revealed that, rather than trying to focus on overcoming the challenges, which draws attention on them, institutions and programs emphasized the drivers for resident involvement in QI, including 1) effective QI curricula, role models and mentors, 2) residency infrastructure that imbeds QI in residents' daily experiences, and 3) QI's appeal to residents, faculty and institutional leaders. Each primary driver has several secondary drivers of resident involvement, shown in ***Figure 1***. Focusing on these drivers allowed institutions to overcome challenges to resident

involvement, include their limited inclusion in planning for "top-down" approaches and the absence of links to organizational goals for many "bottom-up" approaches. , and assumptions by some faculty members that resident do need not learn QI until they have completed they are fully educated. Benefits to institutions and educational programs include improved patient care outcomes, enhanced resident learning and professional development, and increased residents, faculty and other team member engagement and satisfaction.

Figure 1: **Primary and Secondary Drivers for Involvement in QI**

Benefits of resident involvement in QI	**Primary Drivers**	**Secondary Drivers**
• Patient care outcomes • Resident learning and professional development • Resident engagement and satisfaction • Faculty and other team member engagement and satisfaction	Effective QI curricula, role models and mentors	Recruit and develop clinical QI champions who bring these concepts to the bedside Bring QI into residents' daily learning and patient care experiences Develop curricula that integrate educational objectives and institutional QI aims Use "team projects" to "infect" faculty with residents' enthusiasm about QI
	Infrastructure that imbeds QI in residents' daily experiences	Select appropriate resident representation in QI planning, decision making and participation Limit residents' administrative responsibilities on QI teams to maximize improvement exposure Select appropriate content and scope for resident-initiated projects Leverage QI projects as a way to change the way residents learn and engage in clinical care and QI
	QI's appeal to residents, faculty and institutional leaders	Find suitable projects that address problems experienced by the residents Address education needs through appro-priate modules, capitalizing on residents' desire to learn what is required of them Provide IT support to make meaningful data available to the resident/team Facilitate interaction between residents and the institutional leaders to let them view residents as members of the health care team and creative problem solvers

Secondary Drivers: In the area of finding effective QI curricula, role models and mentors, the dearth of clinical champions who bring QI concepts to the bedside can be overcome by actively recruiting and developing promising individuals, concurrent with curricula and learning experiences to bring QI into residents' daily learning and patient care. Faculty mentoring should include encouraging and recognizing residents for their accomplishments related to QI, and coordinating resident-specific education and outreach programs for "top-down" and "bottom-up" approaches. The curriculum needs to integrate educational objectives and institutional QI aims, and finding the optimal amount and timing

of the QI curriculum. Too much curriculum overwhelms interest and thwarts the efforts, while too little curriculum may mean that QI efforts do not succeed.

To overcome challenges posed by the residency infrastructure, time constraints and rotational models of resident engagement, "top-down" initiatives found the optimal mechanisms for resident involvement through representation by senior residents or 'delegates' with an interest in QI. For "bottom-up" QI projects this meant the appropriate subject and scope for projects to allow residents to see their effort to successful conclusion despite time constraints and multiple competing obligations. A way to get residents excited is to show them data about their practice, making it germane to their clinical performance. One institution used Appreciative Inquiry to engage residents in QI, noting AI often look at defects and tries to fix them. In contrast, appreciative inquiry seeks to find the "ideal environment" for care. Part of the appeal of Appreciative Inquiry was that is allowed residents to define "success" for their projects and/or participation in institutional, "top-down" QI. Each primary (or potentially secondary driver could serve as a focal point for institutional or program-level efforts to engage residents in QI. Projects could use data that relate these interventions to measures of the effectiveness at the program- and/or institution-level. This may aid in gaining insight about institutional strengths and areas for improvement, and assist with developing ideas for added data and feedback loops that may be beneficial. The output could be a portfolio of resident projects and a body of learning about how to achieve education objectives and institutional improvement.

Open Questions and Areas for Future Study and Intervention

The project showed that residents, along with faculty, have influence over the quality of care in teaching institutions, and this can be leveraged in positive ways through resident engagement in QI. Institutions reported that they have not fully capitalized on the potentially promising link between QI and improving the health of communities, as suggested by the Dartmouth Leadership Preventive Medicine Residency program. There is agreement residents need to become knowledgeable about and involved in program and institutional QI, but participants question whether current education and clinical setups are prepared for this. All programs and institutions studied are still working to integrate residents' new roles into their clinical and education programs." Attention to the drivers of resident QI may allow a second group of programs and institutions to organize their efforts and make gains in addressing this important competency. At the same time, few institutions are ready to enlist program directors as role-models for improving care, and some focused faculty development may assist in jump-starting this process.

Areas for future study include ideas for improving how QI concepts are taught, given the constraints of current program infrastructure, and whether optimal resident engagement in QI will require major changes to how residencies are organized. A second area entails exploring the benefits of providing residents with data on their practice, as many institutions plan to give residents data on regular basis, including data on patient satisfaction, functional improvement, and data specific to residents' and/or their team's practice. It is not clear to what extent institutional information systems are able to fulfill this need. A third area for study encompasses ways to expand preparation for QI during medical school. Many respondents commented that QI needs to be taught earlier and much more intensively, and become part of the core curriculum, though there was some disagreement about how much of this needs to be move into the undergraduate medical curriculum. A final area for future research relates to mechanisms for the spread of knowledge about QI and acceptance of a QI role among residents and faculty, and how existing social networks in teaching institutions could be leveraged to facilitate wider physician engagement in QI. Another final area for future study concerns the circumstances under which resident involvement benefits resident and the institution, when financial and opportunity costs may outweigh benefits. The outcome could be criteria institutions and programs could use to assess which projects would have a high likelihood of success and the most benefit to residents and others.

A future, broader study also could analyze QI across a broader group of successful programs and institutions for specific models for involving residents in QI, and projects that foster success in resident QI from an educational and patient care perspective. Finally, many organizational leaders do not yet "see" how program directors and residents can be helpful to the improvement efforts they, as organizational leaders, are trying to lead. A practical guide to "what residents can do to contribute to the improvement of care in our institutions" might be a useful resource for teaching hospital leaders.

Individuals Interviewed for the Study

Site representatives for the IHI 100,000 and 5 Million Lives Campaign:

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Bruno DiGiovine, MD, MPH, Henry Ford Health System, Detroit, MI

Javier A Gonzalez del Rey, MD, Cincinnati Children's Hospital Medical Center, Cincinnati, OH

Jack Jordan, Henry Ford Health System, Detroit, MI

Casey Joseph, MPH, Berkshire Medical Center, Pittsfield, MA;

Carol Lannon, MD, Cincinnati Children's Hospital Medical Center, Cincinnati, OH

John Bramhall, MD, PhD, Harborview Medical Center, Seattle, WA

Laura Nelson, RN, Harborview Medical Center, Seattle, WA

Mary Beth Thier, RN, Franklin Square Hospital Center, Baltimore, MD

Representatives from sites with resident-and program-initiated QI and experts on QI teaching and Practice:

Mark Aronson, MD, Beth Israel Deaconess Medical Center, Boston, MA.

Paul Batalden, MD, Dartmouth Hitchcock Medical Center, Lebanon, NH

Roger Bush, MD, Virginia Mason Medical Center, Seattle, WA

Elie Gertner, MD, HealthPartners Institute for Medical Education, Bloomington, MN

Donald Goldman, MD, Institute for Health Care Improvement, Boston, MA

Diane Hartmann, MD, University of Rochester School of Medicine and Dentistry, Rochester, NY

Julie Johnson, PhD, Academic Rapid Response Team and Chronic Care Collaboratives, Association of American Medical Colleges, Washington, DC

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