EXPERIENCE REPORT

Promoting scholarship in improvement science: A model for academic clinical departments

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Abstract

Introduction: Clinical departments at academic medical centers strive to deliver clinical care, provide education and training, support faculty development, and promote scholarship. These departments have experienced increasing demands to improve the quality, safety, and value of care delivery. However, many academic departments lack a sufficient number of clinical faculty members with expertise in improvement science to lead initiatives, teach, and generate scholarship. In this article, we describe the structure, activities, and early outcomes of a program within an academic department of medicine to promote scholarly improvement work.

Methods: The Department of Medicine at the University of Vermont Medical Center launched a Quality Program with three primary goals: (a) improve care delivery, (b) provide education and training, and (c) promote scholarship in improvement science. The program serves as a resource center for students, trainees and faculty, offering education and training, analytic support, consultation in design and methodology, and project management. It strives to integrate education, research, and care delivery to learn, apply evidence and improve health care.

Results: Over the first 3 years of full implementation, the Quality Program supported an average of 123 projects annually, including prospective clinical quality improvement initiatives, retrospective assessment of clinical programs and practices, and curriculum development and evaluation. The projects have yielded a total of 127 scholarly products, defined as peer-reviewed publications and abstracts, posters, and oral presentations at local, regional, and national conferences.

Conclusions: The Quality Program may serve as a practical model for promoting care delivery improvement, training, and scholarship in improvement science while advancing the goals of a learning health system at the level of an academic clinical department. Dedicated resources within such departments offer the potential to enhance care delivery while promoting academic success for faculty and trainees in improvement science.

KEYWORDS
academic medical centers, delivery of health care, faculty, medical, patient safety, quality improvement

1 | INTRODUCTION

Academic clinical departments strive to fulfill multiple missions such as delivering clinical care, providing education and training, supporting faculty development, and promoting scholarship. Increasingly, clinical departments within academic medical centers (AMCs) are expected to measure and advance care quality.[1,2] The number of clinical faculty engaged in quality improvement (QI) and patient safety initiatives has grown as demands have increased to improve care delivery, and improvement science has been recognized as an emerging career pathway.[3] However, many departments still lack an adequate number of clinical faculty with this expertise to lead projects, teach, and generate scholarship.

Improvement science applies evidence-based methodologies to improve the quality, safety, and value of healthcare.[4,5] Improvement science incorporates cycles of planning, implementing, and measuring the impact of changes in specific environments or contexts so that the effectiveness of those changes can be evaluated and optimized.[4] In its ideal form, it yields rapid learning and adaptation of interventions and results in meaningful and sustained improvements in care delivery.[4]

Faculty tracks traditionally have emphasized clinician investigators and educators, yet few mechanisms exist to assist faculty engaged in improvement science to build an academic record and achieve scholarly success.[3] Many clinical faculty encounter quality, safety, and value issues in clinical practice, but have limited opportunities for formal training in QI, and AMCs often lack the infrastructure and resources needed to conduct rigorous and scholarly QI.[2,6,7,8] Successful improvement efforts require diligent design, effective methodology, ethical review, access to timely and reliable data, clinical informatics and analytics, and inter-professional teams.[3] It can be daunting for clinical faculty to navigate these requirements, coordinate teams, and produce scholarship while providing clinical care. Without guidance and support, competing demands preclude many faculty members from undertaking and sustaining these efforts.[3,6,9] Furthermore, administrative quality committees often focus on improving processes of care but not on producing scholarship. Subsequently, faculty members lose opportunities to build an academic portfolio in improvement science to support their reappointment and promotion.

Recently, leaders in academic medicine proposed a framework for developing clinical faculty to improve science and produce scholarship.[6] They identified improvement science as a strategic priority and called for the deployment of resources to enable initiatives and implement training programs. However, there is a paucity of literature describing implementation of programs to foster faculty development and scholarship in improvement science. In this article, we describe the structure, activities, and early outcomes of a program within an academic department of medicine (DOM) to promote scholarly improvement work.

2 | METHODS

2.1 | Context

The University of Vermont (UVM) Medical Center is a 620-bed AMC affiliated with the Robert Larner, MD College of Medicine (LCOM) at UVM. The DOM is the largest department within our AMC and the LCOM, consisting of 12 clinical and 2 research divisions, 224 faculty, and 86 resident and fellow trainees. The DOM Quality Program (Quality Program) was conceived as a resource center to support clinical faculty and trainees in learning improvement science methodologies, applying them to clinical practice, and consequently producing scholarship, defined as peer-reviewed publications and abstracts, posters, and oral presentations at local, regional, and national conferences.

2.2 | Program history and structure

The Quality Program was established in Spring 2017 under the direction of the DOM Chair and the Vice Chair for Quality. While recognizing that many improvement efforts require the engagement of multiple departments and professions, we elected to develop a program within the DOM for several practical reasons. Leadership in the DOM had identified improvement science as a clinical and academic priority and committed departmental funding to the program. A majority of the QI efforts within the department involved local processes and care delivery within specific inpatient medical services and outpatient medical clinics. The departmental focus also allowed the program to target the education and training needs of the department's residency programs. Finally, the departmental structure permitted the program to be readily implemented and assessed, compared to a larger institutional or cross-departmental program, which might require years of budgetary and organizational planning. Nonetheless, the DOM Quality Program encouraged the engagement of inter-professional and cross-departmental stakeholders in the projects it supported, based on the specific needs and scope of each project.

The Quality Program is modeled on an infrastructure described in the academic literature and includes analytic support, project management, and consultation and training in design and methodology.[6,10] The Vice Chair for Quality serves as the program director, overseeing improvement science-related work throughout the department. Between 2017 and 2019, we hired: (a) a "Quality Scholar," who is a faculty member trained in the improvement science and health services research and serves in a consultative role regarding project design, methodological approaches, ethical considerations, and scholarship; (b) a Project Director to provide project management, QI coaching, and assistance with program operations; and (c) a full-time data analyst to assist in data acquisition, analysis, and visualization. Department funding was allocated to create and sustain the program, with expenses partially offset by extramural funding. Annual salary and fringe expenses related to the Quality Scholar (0.85 full-time equivalent [FTE]), Project Director (1.0 FTE), and Analyst (1.0 FTE) positions are approximately 400 000 USD annually, of which 60% is supported by the DOM and 40% is supported by extramural grants.

We raised awareness of the Quality Program services through department-wide communications, social media, and our website, and deliberately attempted to minimize barriers to accessing Quality Program services. Programmatic services are without financial cost to

DOM faculty and trainees, as long as the project's primary faculty member commits to advancing the project to scholarship. Requests for assistance can be made in person, via e-mail, or through a short, online application. We emphasized scholarship to promote the application of rigorous and reproducible improvement methodology, assessment of the impact of the initiatives, development and academic advancement of clinical faculty, and availability of the lessons learned to an audience beyond our department and institution.

2.3 | Activities

The Quality Program is committed to enhancing the quality, safety, and value of care delivery. Our mission statement and programmatic goals enumerate three focus areas: (a) to improve care delivery, (b) to provide education and training, and (c) to promote scholarship (see Table 1). DOM faculty and trainees can request assistance with specific tasks or activities, such as developing project charters, formulating protocols and analytic plans, coordinating inter-professional teams, applying methodologies, submitting institutional review board applications, identifying scholarship opportunities (eg, peer-reviewed journals and professional society meetings), and editing and submitting manuscripts, abstracts, and posters. Through providing these resources, the Quality Program supports faculty and trainees with implementing improvement projects, assessing the impact of those efforts, and disseminating the results.

2.4 | Improving care delivery

The Quality Program promotes care delivery improvement in several ways. First, we assist with QI initiatives advanced by clinical divisions. These initiatives focus on clinical care and operational improvements led by physician QI champions designated within each division. We request that divisional initiatives align with departmental or institutional priorities. The Vice Chair for Quality leads the DOM's Quality Assurance and Improvement (QA&I) Committee that evaluates performance standards, reviews divisional QI initiatives, and offers a forum for sharing improvement activities across clinical divisions.

TABLE 1 Department of medicine quality program mission and goals

Mission
We serve as a resource center and laboratory to support improvement in care delivery, education and training, and scholarship in quality, safety, and value in the Department of Medicine at the University of Vermont Medical Center
Goals
1. Coordinate and support efforts to improve the quality, safety, and value of care and assess the impact of those efforts
2. Enhance the knowledge, skills, and application of improvement science for faculty and trainees
3. Promote scholarship in improvement science focusing on quality improvement, patient safety, and high value care

Next, we support improvement initiatives conducted by individual faculty, which are often single-clinic projects focusing on small tests of change. We encourage front-line clinicians to identify gaps in quality or safety and opportunities to apply new evidence or guidelines into practice. Project leaders, who are DOM physician faculty or trainees, can request specific types of support—such as design, project management, or analytics—from the Quality Program based on the needs of the individual projects and teams. The project teams vary in composition, depending on the scope and focus of the project—often including physicians, trainees, students, nurses, pharmacists, or other stakeholders within and outside of the DOM. Similarly, the Quality Program resources requested by the project teams differ considerably, reflecting the scale, goals, and team membership.

Additionally, we oversee a high-value care program, in which faculty and trainees identify opportunities within the DOM's clinical scope to reduce unnecessary tests or treatments.[11] Faculty and trainees submit proposals for high-value care projects which are then scored based on impact and feasibility. Selected projects receive close support from the Quality Program to advance the project rapidly through the planning, implementation, and measurement phases.

We also collaborate across departments to improve systems of care. One example is a project focusing on pediatric-to-adult health care transitions for patients with chronic illnesses. This project is jointly managed between the Quality Program and the Vermont Child Health Improvement Program in the Department of Pediatrics.[12,13]

2.5 | Education and training in improvement science

Our team provides education and training addressing the knowledge, skills, and application of improvement science. We conduct a three-year, longitudinal, active-learning improvement science curriculum for all internal medicine residents. The curriculum includes modules focused on QI, patient safety, population health, and high value care and addresses Accreditation Council for Graduate Medical Education milestones. We offer an active learning curriculum for faculty to improve their knowledge and application of QI methodology. We launched a "Scholarly QI Interest Group" for faculty based on previous calls for opportunities for faculty to engage with colleagues in their work.[6,7] Also, our program hosts an annual improvement science speaker at the DOM Grand Rounds, and the Vice Chair for Quality advises the Chief Medical Residents in the development of the department's monthly morbidity and mortality conference, incorporating QI and patient safety principles into conference discussions.

2.6 | Promoting scholarship

The Quality Program emphasizes and promotes scholarship through collaborating with faculty and trainees on designing projects, ethics review, data acquisition, data storage and stewardship, analyses, and reporting results. We offer editorial support that includes reviewing

and editing manuscripts and abstracts in accordance with the Standards for QUality Improvement Reporting Excellence (SQUIRE) guidelines,[14] as well as identifying target journals and conferences. We established an annual "Department of Medicine Quality Showcase" event consisting of platform presentations and a poster session open to students, trainees, and faculty. Additionally, the DOM QA&I Committee selects a faculty recipient annually for the "Department of Medicine Quality Scholarship Award" via a peer nomination process to recognize sustained excellence in scholarly improvement science.

3 | RESULTS

The Quality Program has developed measures to evaluate the effectiveness of our services which align with our program goals—care delivery improvement, education and training, and scholarship in improvement science—and are tracked through REDCap electronic data capture tools hosted at UVM.[15] We compile an annual summary of these measures into a report submitted to the DOM Chair. Over the past three fiscal years, we have observed increases in the total number of projects supported by the Quality Program (Table 2).

3.1 | Improving care delivery

The Quality Program supports divisions, faculty or trainees in conducting clinical QI projects based on their specific requests or needs. Examples of completed initiatives to improve care delivery within divisions include implementation of routine hepatitis C screening in hospitalized adults (Division of Infectious Disease) and promoting guideline-concordant use of basal-bolus insulin regimens in inpatients with type 2 diabetes (Division of Hospital Medicine).[16,17] Similarly, individual faculty members or trainees in the department may

undertake efforts to improve care value, such as a resident-led effort to promote appropriate utilization of laboratory tests for inflammation.[18] A table summarizing the clinical QI initiatives supported by the Quality Program during fiscal years 2019 through 2021 are provided in Supporting Information.

3.2 | Education and training in improvement science

We are currently in the fifth year of delivering the longitudinal improvement science curriculum for internal medicine resident physicians. As we evaluate components of the curriculum, we have published our experiences to assist other programs interested in implementing improvement science curricula.[19,20,21] Early career faculty with an interest in improvement science have assisted with curricular delivery, assessment and publication. Our goal is to encourage these faculty to assume progressive leadership roles, support their professional development, and create a cadre of role-models and mentors for improvement science within the DOM. Outside of this curriculum, the Quality Program has supported DOM faculty in developing and evaluating curricula to educate medical students and resident physicians about opioid prescribing and managing opioid use disorder.[22,23]

3.3 | Promoting scholarship

In addition to the aforementioned efforts to improve care delivery and provide training, the Quality Program supports faculty and trainees who are interested in research related to quality, safety and value of care. Examples include an assessment of the impact of a nursing strike on diabetes care in the hospital and an investigation of the

Measures	Number by fiscal year[a]		
	2019	2020	2021
Number of supported projects[b]	78	120	170
By role of project lead			
Faculty	37	53	75
Fellow	9	14	18
Resident	28	43	63
Medical student	4	10	14
Number of scholarly products[c]	36	51	40
Peer-reviewed publications	6	7	17
National and regional abstracts/posters/platform presentations	7	18	8
Local abstracts/posters/platform presentations	23	26	15

TABLE 2 Department of medicine quality program measures

[a]Fiscal year defined as 1 October-30 September.
[b]Supported projects include any projects that used Quality Program Services (eg, Analytic Support, Consultation, Project Management) during the fiscal year.
[c]Products by publication/presentation date.

association of COVID-19 policies on patients' experiences on a hospital oncology service.[24,25] To date, Quality Program-supported projects have resulted in 30 peer-reviewed publications, 33 posters at regional or national meetings, and 64 other scholarly products. A list of peer-reviewed publications from fiscal year 2019 through fiscal year 2021 is provided in the Supporting Information. Over the past several years, we have observed a transition in scholarly products from abstracts and posters to peer-reviewed publications (Table 2). As of January 2022, we are supporting 99 open projects, ranging from periodic consultations to full project management and coaching.

4 | DISCUSSION

The Quality Program offers a feasible model for promoting care delivery improvement, training, and scholarship in improvement science at the level of an academic clinical department. Results indicate substantial demand for the Quality Program services and scholarly output. We believe dedicated resources within such departments can enhance care delivery while promoting academic success for faculty and trainees in improvement science.

The Quality Program evolved from recommendations that clinical departments develop the capacity to assist faculty working in QI and patient safety.[6,10] Many key elements proposed in the literature were incorporated in the Quality Program structure[10,26]: training opportunities in improvement science methodology and scholarship[6]; involvement of leadership[8]; analytic support, consultation on project design and methodology, and project management[7,9]; QI coaching utilizing relevant methods and tools[27]; and use of planning and reporting tools.[9] We have integrated these elements into a resource center that empowers clinical faculty and trainees to complete projects that improve the quality, safety, and value of care delivery.

We developed the Quality Program within the DOM because departmental leadership identified improvement science as a clinical and academic priority. The departmental focus has afforded a number of benefits. It allowed ready implementation, growth, and assessment of the program, compared to a larger institutional or cross-departmental program. The clinical improvement and educational initiatives supported by the Quality Program address specific needs and requirements of medicine specialties and their training programs. By design the Quality Program emphasizes scholarship, an element that may be overlooked in hospital-based quality committees and improvement projects, allowing the dissemination of information so that others outside the DOM may benefit. Fortunately, the departmental structure does not seem to impede inter-disciplinary and inter-professional collaboration. Improvement initiatives supported by the Quality Program have engaged stakeholders from multiple professions or departments, who often welcome the opportunity to participate and the Quality Program services. We have been able to develop relationships and processes to collaborate efficiently with existing institutional services, such as the data management office and informatics. While it promotes agility and local improvement efforts, the departmental focus and relatively small size of the Quality Program limits the scope of the improvement projects supported by the program.

There are few published descriptions of similar programs in academic clinical departments. Mathews et al[2] described an organizational structure within one DOM, including administrative leadership and committee functions to advance quality and safety. In addition to leadership, our program focuses on peer-to-peer mentoring, project management, and analytic support to effect meaningful QI and produce scholarships. Boudreaux and Vetter[10] reported on the creation of a section on quality and patient safety in an academic department of anesthesia, with a focus on clinical improvement work, but did not report on specific scholarship goals or outcomes. Scholarship outcomes are an explicit goal of our Quality Program.

McKinney et al[28] described the integration of an Academic Research Coach into a Division of General Internal Medicine at an AMC with a similar goal of engaging clinical faculty in meaningful scholarly work and increasing scholarly productivity. Like the Quality Scholar in our program, the Academic Research Coach consulted with faculty physicians and supported the development of publications and abstracts. While the Academic Research Coach focused on a single division within an academic DOM, the Quality Program supports all the divisions within our DOM. The Quality Program not only promotes scholarship, it also supports clinical QI efforts, helps to coordinate QI efforts across the department, leads educational efforts in improvement science, and engages trainees and students as well as faculty. The Quality Program promotes inter-divisional, inter-departmental, and inter-professional teams whenever possible, and, similar to the Academic Research Coach model described by McKinney et al, inter-professional team members often contribute to resulting scholarly work.

The Quality Program embraces the core principles of a learning health system. A learning health system, as envisioned by the Institute of Medicine, generates "evidence by driving the process of discovery as a natural outgrowth and product of care."[29] A learning health system integrates education, research, and care delivery to learn, apply evidence, and improve health and health care.[30] Aspiring to achieve the virtuous cycles articulated by Magill and Baxley,[31] the Quality Program attempts to align education in improvement science, care delivery improvement, and scholarship in improvement science. Returning to examples of completed initiatives, the effort to promote appropriate utilization of laboratory tests for inflammation was led by a resident physician who had received training in the fundamentals of improvement science. The project progressed through an initial study of local laboratory ordering practices to educational and health record interventions to provide clinical decision support at the time of ordering. Further study led to modifications of the interventions to optimize effectiveness and sustainability, and ultimately, dissemination of the learning beyond our institution through peer-reviewed publication.[18] In contrast, we learned that routine hepatitis C screening in hospitalized adults was a low-value practice, prompting discontinuation of the initiative.[16] Publication of a description of the hepatitis C screening initiative may help other institutions avoid applying resources to similar efforts.[16]

Since the inception of the Quality Program, our team has faced several challenges. Despite developing processes to obtain electronic health record data more efficiently, we have frequently encountered delays in obtaining electronic health record data due to high institutional demand and limited resources for data reporting, occasionally slowing improvement work and resulting scholarship. To address this issue, the Quality Program data analyst is undergoing training to fulfill data requests and generate reports directly from our electronic health record system. Also, the relatively short timeframe for the completion of trainee-led projects has presented challenges to manuscript publication. In some cases, residents or fellows have continued to collaborate with the Quality Program on projects after completing their training programs, while in other cases faculty mentors have assumed responsibility for advancing the work to scholarship. Also, publication fees associated with reputable, open-access journals have created a barrier for some faculty, although all faculty are provided with continuing medical education funds that can be used to offset these expenses. The improvement science curriculum for residents have been successful in part due to dedicated academic time for residents every week, which allows consistent participation. Conversely, engaging clinical fellows have been more difficult, as there are few structured opportunities to implement a common curriculum. We anticipate the demand for Quality Program services will continue to grow due to increasing awareness of the services and the expansion of our multi-hospital health network with an evolving, network-wide DOM. This prospect offers the opportunity to optimize care delivery across network sites and extend the scope of scholarship in improvement science.

4.1 | Adapting during the coronavirus disease 2019 pandemic

Since the beginning of this pandemic, program operations transitioned to a hybrid format. To our surprise, we experienced an increase in requests for our services. We utilize video-conferencing platforms to conduct meetings, conferences, and curricular sessions. The annual Quality Showcase was converted to a virtual format that utilized a web-based interactive site with voice-over poster presentations, which has been well received by attendees. Anecdotally, we have observed increased participation in virtual meetings from faculty and trainees located in different clinical sites. Most key programmatic activities have continued remotely, including institutional review board applications, data acquisition and analysis, project management tasks, and editorial support. In contrast, the Scholarly QI Interest Group was suspended during the pandemic and has not yet reconvened. The Quality Program team has held twice-weekly program meetings and encouraged unscheduled conversations with faculty and trainees via phone, video-conference, and e-mail to facilitate communication during the pandemic.

5 | CONCLUSION

The Quality Program offers a practical model for promoting care delivery improvement, training, and scholarship in improvement science within an academic medicine department. Results suggest effectiveness, as evidenced by scholarship products and demand for Quality Program services. Continued program evaluation, including assessment of its impact on care delivery and health outcomes, is needed to understand the impact of the Quality Program as a learning health system.

CONFLICT OF INTEREST

The authors report no relevant conflict of interest.

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REFERENCES

1. Bergman B, Hellstrom A, Lifvergren S, Gustavsson SM. An emerging science of improvement in health care. *Qual Eng*. 2015;27(1):17-34. doi:10.1080/08982112.2015.968042
2. Mathews SC, Pronovost PJ, Biddison ELD, et al. A Department of Medicine infrastructure for patient safety and clinical quality improvement. *Am J Med Qual*. 2018;33(4):413-419. doi:10.1177/1062860617743324
3. Shojania KG, Levinson W. Clinicians in quality improvement: a new career pathway in academic medicine. *JAMA*. 2009;301(7):766-768. doi:10.1001/jama.2009.140
4. Institute for Healthcare Improvement. Science of improvement. http://www.ihi.org/about/Pages/ScienceofImprovement.aspx. Accessed July 3, 2020.
5. Cribb A. Improvement science meets improvement scholarship: reframing research for better healthcare. *Health Care Anal*. 2018;26(2):109-123. doi:10.1007/s10728-017-0354-6
6. Coleman DL, Wardop RM, Levinson WS, Zeidel ML, Parsons PE. Strategies for developing and recognizing faculty working in quality improvement and patient safety. *Acad Med*. 2017;92(1):52-57. doi:10.1097/ACM.0000000000001230
7. Austin JM, Pronovost PJ. Improving performance on core processes of care. *Curr Opin Allergy Clin Immunol*. 2016;16(3):224-230. doi:10.1097/ACI.0000000000000260
8. Rivard PE, Parker VA, Rosen AK. Quality improvement for patient safety: project-level versus program-level learning. *Health Care Manage Rev*. 2013;38(1):40-50. doi:10.1097/HMR.0b013e318245019f
9. Jones B, Vaux E, Olsson-Brown A. How to get started in quality improvement. *BMJ*. 2019;364:k5408. doi:10.1136/bmj.k5437
10. Boudreaux AM, Vetter TR. The creation and impact of a dedicated section on quality and patient safety in a clinical academic department. *Acad Med*. 2013;88(2):173-178. doi:10.1097/ACM.0b013e31827b53dd
11. Stinnett-Donnelly JM, Stevens PG, Hood VL. Developing a high value care programme from the bottom up: a programme of faculty-resident improvement projects targeting harmful or unnecessary care. *BMJ Qual Saf*. 2016;25(11):901-908. doi:10.1136/bmjqs-2015-004546
12. Teneback C, DeVoe S, Kennedy A, et al. Improving health care transitions for young adults at an adult cystic fibrosis center: a quality improvement. *Pediatr Pulmonol*. 2020;55(suppl 2):S333-S361. doi:10.1002/ppul.25089
13. Gilbert MP, DeVoe SG, Kennedy AG, et al. Improving the quality of health care transitions for young adults at an adult endocrinology clinic. *Diabetes*. 2021;70(suppl 1):852-P.
14. Ogrinc G, Davies L, Goodman D, Batalden PB, Davidoff F, Stevens D. SQUIRE 2.0 (Standards for QUality Improvement Reporting Excellence): revised publication guidelines from a detailed consensus process. *BMJ Qual Saf*. 2016;25(12):986-992. doi:10.1136/bmjqs-2015-004411

15. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)–a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381. doi:10.1016/j.jbi.2008.08.010

16. Whitman TJ, Noyes CD, Hale AJ, et al. Impact and costs of a hepatitis C virus screening programme for adults hospitalised at an academic medical centre. *BMJ Open Qual*. 2021;10:e001248. doi:10.1136/bmjoq-2020-001248

17. Wahlberg EA, Muthukrishnan P, Burnett M, Barrett KV, Gilbert M, Repp AB. Improving management of type 2 diabetes mellitus in hospitalized adults: a quality initiative. *J Healthc Qual*. 2021;43(2):e20-e25. doi:10.1097/JHQ.0000000000000298

18. Bartlett KJ, Vo AP, Rueckert J, et al. Promoting appropriate utilisation of laboratory tests for inflammation at an academic medical centre. *BMJ Open Qual*. 2020;9(1):e000788. doi:10.1136/bmjoq-2019-000788

19. Muthukrishnan P, Burnett M, DeVoe SG, et al. An active-learning quality improvement curriculum for faculty in Hospital Medicine. *J Contin Educ Health Prof*. 2021;42:70-73. doi:10.1097/CEH.0000000000000354

20. Kennedy AG, Burnett M, Muthukrishnan P, Sobel H, van Eeghen C, Repp AB. "I think I was losing the forest for the trees:" evaluation of an Internal Medicine residency quality improvement curriculum. *Med Sci Educ*. 2020;30:197-202. doi:10.1007/s40670-019-00854-7

21. Wahlberg KJ, Burnett M, Muthukrishnan P, et al. Partnering with patients in a quality improvement curriculum for Internal Medicine residents. *J Patient Exp*. 2021;8:1-6. doi:10.1177/2374373521999604

22. Sobel HG, Goedde M, Maruti S, Hadley-Strout E, Wahlberg E, Kennedy AG. Primary care residents delivering care: integration of office-based opioid treatment into an internal medicine residency curriculum. *Acad Psychiatry*. 2019;43(5):499-502. doi:10.1007/s40596-019-01069-z

23. Riser E, Holterman LA, Maruti S, et al. Integrating DATA 2000 waiver training into undergraduate medical education: the time is now. *Subst Abus*. 2021;42(2):236-243. doi:10.1080/08897077.2021.1903653

24. Sheahan KH, Kennedy AG, Tompkins BJ, Repp AB, Gilbert MP. The impact of a nursing strike on glycemic control in hospitalized patients with diabetes. *Cureus*. 2021;13(6):e16020. doi:10.7759/cureus.16020

25. Bolton KC, Lawler M, Hauptman J, et al. Patient experience on a hospital oncology service before and after implementation of a no-visitor policy during COVID-19. *J Patient Exp*. 2021;8: 23743735211034620. doi:10.1177/23743735211034620

26. Abraham C, Kleinpell R, Godwin KM, Dolansky MA. The interprofessional Veterans Affairs Quality Scholars program pre- and postdoctoral nurse fellow outcomes. *Nurs Outlook*. 2021;69(2):202-211. doi:10.1016/j.outlook.2020.09.003

27. Olds DM, Dolansky MA, Gali K, Callaway-Lane C. VA Quality Scholars quality improvement coach model to facilitate learning and success. *Qual Manag Health Care*. 2018;27(2):87-92. doi:10.1097/QMH.0000000000000164

28. McKinney CM, Mookherjee S, Fihn SD, Gallagher TH. An Academic Research Coach: an innovative approach to increasing scholarly productivity in medicine. *J Hosp Med*. 2019;14(8):457-461. doi:10.12788/jhm.3194

29. Institute of Medicine. *The Learning Healthcare System: Workshop Summary*. Washington, DC: National Academies Press; 2007.

30. Grumbach K, Lucey CR, Johnston SC. Transforming from centers of learning to learning health systems: the challenge for academic health centers. *JAMA*. 2014;311(11):1109-1110. doi:10.1001/jama.2014.705

31. Magill MK, Baxley E. Virtuous cycles: patient care, education, and scholarship in the patient-centered medical home. *Fam Med*. 2013; 45(4):235-239.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.