Sustainability in Action: A Financial Incentive for Trainees Embracing Environmentally Friendly Quality Improvement Projects

Esther H. Chen, MD
Elena Fuentes-Afflick, MD, MPH

ABSTRACT

Background Engaging and motivating busy trainees to work on reducing the climate impact of their clinical practice is challenging. To our knowledge, there are no published studies of graduate medical education (GME)–wide, institutional efforts to engage residents in implementing climate sustainability improvement projects.

Objective We piloted a novel, institution-wide, pay-for-performance (P4P) sustainability quality improvement (SusQI) program in 2023-2024 that enabled residents from all GME programs to implement SusQI projects with practice-changing improvement goals for a financial incentive.

Methods Project leaders were provided an opportunity to implement a project by identifying a SusQI problem and collaborating with stakeholders toward meeting environmentally friendly monthly improvement goals for an incentive payment. Eligible residents who reached their monthly goal for 6 months of the academic year would receive $400.

Results Of the 4 SusQI projects approved for the P4P program, 3 remained active after 6 months. One project stalled because of institutional barriers. Two hundred and ten residents participated. Environmental impacts included an increase in low anesthetic gas flow use in operating room cases (mean [SD] 25% to 53% [0.1]), increase of radiology workroom waste sorting into recycling and composting bins (mean [SD] 20% to 58% [0.1]), and increase in emergency department instruments recycled (mean [SD] 9% to 24% [0.2]). Two hundred and ten residents are set to receive $84,000 at the end of the year for meeting their SusQI goals.

Conclusions We were able to integrate sustainability into QI programs by implementing an institution-wide pay-for-performance SusQI program that encouraged residents to develop and implement environmentally friendly practice projects.

Introduction

Health professionals who are also clinician educators have been charged by the Global Consortium on Climate and Health Education to respond to the health impacts of climate change, to teach trainees the core concepts about health care's contribution to the climate crisis, and to prepare them to apply sustainability to clinical practice.[1] Curricula can teach foundational knowledge about environmentally friendly practices,[1,2] but are limited by the paucity of data about how patient care practices impact the environment.[3] A quality improvement (QI) approach to sustainability can help to operationalize this knowledge through projects with outcomes geared toward the 5 principles of sustainable practice: disease prevention, patient empowerment, Lean pathways, low carbon alternatives, and operational resource use.[2] Experiential learning through participating in tangible projects can increase learner engagement for QI initiatives and sustainable practices.[4] Moreover, learners who participate in sustainable quality improvement (SusQI) projects are more likely to take action to reduce the environmental impact of their future work.[5]

Building on the work that started in undergraduate medical education, there is increasing excitement about incorporating sustainability into graduate medical education (GME).[2] However, motivating busy residents to engage in sustainable practice may be more challenging than in undergraduate learners. To our knowledge, there are no published studies of an institutional approach to promote sustainability that focuses on empowering residents. We piloted a novel approach to teach sustainable practice by incorporating climate sustainability projects into our institution's pay-for-performance (P4P) program. The voluntary P4P program, described elsewhere, provides a financial incentive for trainee-led QI initiatives and has been successful in changing resident practices toward meeting monthly improvement goals every year, for a maximum of $1,200 per individual.[6] For the departmental project, residents within a program are mentored by the department's QI faculty and work together toward meeting their monthly QI project goal for an incentive payment.

DOI: http://dx.doi.org/10.4300/JGME-D-24-00059.1

Editor's Note: The online supplementary data contains the Housestaff Incentive Program Proposals template.

Leveraging our experience with leading a QI P4P program, we describe the feasibility of incorporating SusQI projects in this GME-wide P4P program, the lessons learned, and the outcomes shown by engaging residents to adopt environmentally friendly practices to meet their SusQI project goals in addition to their patient-focused QI project goals.

Methods

Setting and Participants

Our institution is a 400-bed, busy, urban, public hospital and trauma center. The hospital is affiliated with a research-intensive university and hosts about 900 trainees from 18 programs every year.

Interventions

From February to June 2023, the P4P program director (E.H.C.) emailed the call for project proposals to all departmental chiefs, QI faculty, education leaders, and trainees to implement resident-led SusQI projects for the annual incentive payment and made program announcements at the monthly GME committee meetings and departmental chiefs meetings. For these proposals, the residents were required to describe the problem they were trying to solve, analyze the problem using a fishbone diagram, discuss with stakeholders their plan with countermeasures, and propose a resident behavior change toward a monthly improvement goal (online supplementary data). Residents were allowed to propose tiered goals (eg, $200 goal and $400 "stretch" goal). All trainees who worked at least 88 days at the hospital could receive up to $400 for meeting their monthly SusQI project goal for at least 6 months of the 2023-2024 academic year. Projects were required to align with their affiliated academic departments' QI goals and be approved by their departments' chief and QI faculty. Project leaders were required to attend and discuss the progress of their projects at the quarterly GME committee meetings.

Program funding was negotiated for by the Committee for Interns and Residents as part of their collective bargaining agreement. The GME finance office administers the incentive payment in the residents' paychecks at the end of the fiscal year.

Outcome Measures and Analysis

For each project, project leaders submitted to the P4P program director their problem analysis, countermeasures, a self-defined outcome that assessed the impact of their interventions, and monthly improvement goals prior to implementation and at the 6-month project evaluation. They were required to show how their specific behavior change directly affected their proposed outcome. Monthly data were submitted to the P4P program analyst. Outcomes data are presented as descriptive statistics, using means and standard deviations.

The QI program is exempt from institutional review board review.

Results

Half (9 of 18) of the training programs proposed QI projects and, of these, 4 (44%) were SusQI projects (TABLE 1). After several months of effort, the Green Certification project stalled because of institutional barriers related to switching to low-carbon alternatives. Two hundred and ten residents worked on 3 SusQI projects: anesthesia (90), radiology (59), emergency medicine (61).

TABLE 1 shows the 6-month project outcomes. Environmental impacts included an increase in low anesthetic gas flow use in operating room cases (mean [SD] 25% to 53% [0.1]), increase of radiology workroom waste sorting into recycling and composting bins (mean [SD] 20% to 58% [0.1]), and increase in emergency department instruments recycled (mean [SD] 9% to 24% [0.2]). Two hundred and ten residents are set to receive $84,000 at the end of the year for meeting their SusQI goals. TABLE 2 shows the initial and 6-month problem analysis and countermeasures implemented for each SusQI project.

Discussion

Incorporating SusQI projects into a P4P program to support experiential learning about sustainable health care practices was challenging, despite using a well-established QI program infrastructure that was familiar to faculty and trainees. GME P4P programs have been shown to successfully elicit resident participation in departmental and hospital-wide QI efforts and we had expected to see similar resident engagement.[6,7] During our pilot, residents proposed and implemented more patient-focused than SusQI projects, possibly because departments were more likely to have established QI, rather than SusQI, initiatives. Four SusQI projects were implemented and, after 6 months of effort, 1 project could not overcome institutional barriers to remain active. Among the 3 active projects, the residents have made variable success toward their monthly goals.

Residents reported distinct challenges associated with implementing SusQI projects. A simple project to promote waste recycling and composting in the radiology workrooms was challenging to implement because residents needed to engage the hospital's Environmental Services to provide new collection bins,

TABLE 1
SusQI Projects Categorized by the Principles of Sustainable Clinical Practice[3,8]

Training Program	Sustainable Clinical Practice Framework	Problem	Project Description and Goal(s)[a]	6-Month Project Outcome, mean (SD)
Anesthesiology	Lean pathways	Inhaled anesthetic agents are released into the atmosphere and contribute to hospital's CO_2 emissions	Increase percent of operating room cases using low inhaled anesthetic gas flow ($\leq$2L/m) from 25% (baseline) to 35% ($200) or to 40% ($400)	53% (0.1)
Radiology and biomedical imaging	Operational resource use	Few recycling and no compost bins in the resident workrooms for waste disposal	Increase waste sorting into waste, recycling, and compost bins to improve radiology resident workroom cleanliness from <20% sorting (baseline) to 50% ($200) and 70% ($400)	58% (0.1)
Emergency medicine	Operational resource use and low carbon alternatives	Used instruments are disposed into sharps container rather than in recycling bins	Increase % instruments from bedside procedure kits placed in recycling bins in the emergency department from 9% (baseline) to 30% ($200) and 40% ($400)	24% (0.2) and 10.9 kg total instruments recycled
Pediatrics	Operational resource use and low carbon alternatives	Clinical areas are not green certified	Complete 3 points each month on the University of California San Francisco Green Certification checklist ($400)[b]	Project withdrawn from participation

[a] Tiered goals include a $200 goal and a $400 goal.
[b] Green certification: https://campuslifeserviceshome.ucsf.edu/sustainability/certifications.
Abbreviation: SusQI, sustainability quality improvement.

develop a workflow for recycling and compost disposal, and propose an easily measurable outcome that documented progress of their collective efforts. Outcome measures for QI projects were traditionally extracted from the electronic health record, but SusQI metrics required different data sources. The residents implemented creative solutions, such as submitting photos of waste bins or weighing instrument recycling bins each month. Moreover, QI faculty may not be accustomed to applying the Lean methodology to sustainability and may have been less prepared to assist trainees in overcoming institutional barriers, as shown by the Green Certification project that failed to progress. To implement instrument recycling, for example, a faculty mentor sought approval from hospital committee leaders (eg, Safety Device Committee, Infection Control Officer, Medical Executive Committee members) and urged a change to a recyclable alternative, but this approval process lasted over a year. A complex approval process and lengthy timeline are not feasible for busy residents. Our projects were more likely to be successful when they were supported by strong faculty mentorship and included an interdisciplinary team of project leaders.

Our pilot program has several limitations. The program was implemented within an urban public hospital with a robust QI infrastructure and our experience may not be easily generalizable to other health care systems. While the program is intended as a 12-month pilot, we report 6 months of data and don't have the final list of trainees receiving the incentive. However, we believe that our experience with SusQI and initial lessons learned are important to share as institutions develop a strategy to incorporate residents into their sustainability efforts.

As we plan for future projects, we will incorporate evidence-based strategies to increase resident participation in SusQI.[5] We will incorporate the sustainable practice framework into our call for proposals and showcase the projects in the education section

TABLE 2
SusQI Projects Problem Analysis and Countermeasures

Project	Problem Analysis and Countermeasures	6-Month Project Analysis and New Countermeasures
Low inhaled anesthesia project	1. Anesthesia providers don't know about environmental effects of high inhaled anesthetic gas flow for OR cases→climate sustainability education provided during residency conference. 2. Anesthesia providers couldn't track the anesthetic gas flow rate→collaborate with EPIC analyst on a clinical decision support tool to alert providers when gas flow is >1L/minute. 3. New anesthesia residents rotating each month don't know about the SusQI project→monthly email to entire department highlighting top performing providers, monthly report of top performers on department's QI OR bulletin board.	1. Low performing providers are not aware of their practices→project leaders provide feedback to providers on their individual practices.
Waste sorting project	1. No workflow for placing, removing, and replacing waste, recycling, and compost bins in the 5 radiology reading and conference rooms→collaborate with environmental services on adding recycling and compost bins and workflow for removing and replacing bins. 2. No method for tracking and measuring proper waste sorting into waste, recycling, and compost bins→photos of waste, recycling, compost bins taken twice a month and submitted to program analyst as evidence of appropriately sorted trash. 3. Residents don't know about recycling and compost bins in the reading rooms→monthly communication to rotating residents about depositing trash into different bins.	1. New residents rotating through each month don't know about trash sorting project→post flyers with location of bins to remind residents and faculty about trash sorting project.
Instrument recycling project	1. Procedure kit instruments are not recyclable→collaborate with hospital leadership, infection control, safety device committee, kit manufacturer to approve and switch to recyclable instruments. 2. No workflow for stocking, removing, and replacing full recycling bins in the ED→collaborate with ED nursing leadership, ED medical supplies coordinator, kit manufacturer sales consultant to create workflow. 3. ED providers don't know about where to deposit used instruments→coordinate with senior residents, chief residents, faculty on a comprehensive communication strategy (teaching point during sign-out, monthly newsletter announcements, reminders during residency conference). 4. No method for tracking and measuring recycling progress→coordinate with the hospital's central supplies analyst to send monthly report of kits replaced; project leaders weighed recycling bins in the first week of each month.	1. Non-emergency medicine (EM) providers don't know where to deposit used instruments→expanded communications to medical student rotators, non-EM resident rotators, and nurse practitioners and instrument recycling flyers posted in the supply room. 2. Monthly report of kits replaced may not be accurately reflect procedures performed→collaborate with EPIC analyst to generate the number of procedure notes written each month as a proxy for the total number of used kits.

Abbreviations: SusQI, sustainability quality improvement; OR, operating room; QI, quality improvement; ED, emergency department.

of our institution's website to help generate project ideas. We will identify health system partners who are willing to collaborate on sustainability efforts and facilitate resolution of institutional barriers. Our goal is to train our residents to use the SusQI framework as they develop their projects, rather than consider QI and sustainability separately, but it will take time to change this mindset. We anticipate that residents and QI faculty who "learn by doing" SusQI work will be encouraged to continue to apply Lean principles toward improving sustainable practices and take action to reduce the environmental

impact of their future work. Even though we believe we were able to assess trainee engagement through their collective effort toward their project goal, we will conduct a program evaluation by surveying the residents and QI faculty about resident engagement and program impact.

Conclusions

We were able to integrate sustainability into QI programs by implementing an institution-wide pay-for-performance SusQI program that encouraged residents to develop and implement environmentally-friendly practice projects.

References

1. Columbia Mailman School of Public Health. Core competencies: climate and health core concepts for health professionals. Accessed April 2, 2024. https://www.publichealth.columbia.edu/research/centers/global-consortium-climate-health-education/core-competencies
2. Gandhi V, Al-Hadithy N, Gopfert A, Knight K, van Hove M, Hockey P. Integrating sustainability into postgraduate medical education. *Future Healthc J*. 2020;7(2):102-104. doi:10.7861/fhj.2020-0042
3. Alshqaqeeq F, Amin Esmaeili M, Overcash M, Twomey J. Quantifying hospital services by carbon footprint: a systematic literature review of patient care alternatives. *Res Conserv Recycl*. 2020;154:104560.
4. Clemo R, Parsons AS, Boggan JC, Shieh L, Miller BP. Learning by doing: practical strategies to integrate resident education and quality improvement initiatives. *J Grad Med Educ*. 2021;13(5):631-634. doi:10.4300/JGME-D-21-00381.1
5. Clery P, d'Arch Smith S, Marsden O, Leedham-Green K. Sustainability in quality improvement (SusQI): a case-study in undergraduate medical education. *BMC Med Educ*. 2021;21(1):425. doi:10.1186/s12909-021-02817-2
6. Chen EH, Losak MJ, Hernandez A, Addo N, Huen W, Mercer MP. Financial incentives to enhance participation of resident physicians in hospital-based quality improvement projects. *Jt Comm J Qual Patient Saf*. 2021;47(9):545-555. doi:10.1016/j.jcjq.2021.04.004
7. Vidyarthi AR, Green AL, Rosenbluth G, Baron RB. Engaging residents and fellows to improve institution-wide quality: the first six years of a novel financial incentive program. *Acad Med*. 2014;89(3):460-468. doi:10.1097/ACM.0000000000000159

Esther H. Chen, MD, is Professor of Emergency Medicine and Associate Residency Director, Department of Emergency Medicine, and Director of Graduate Medical Education, Zuckerberg San Francisco General Hospital, University of California, San Francisco, San Francisco, California, USA; and **Elena Fuentes-Afflick, MD, MPH,** is Vice Dean, Zuckerberg San Francisco General Hospital, and Professor of Pediatrics, Department of Pediatrics, University of California, San Francisco, San Francisco, California, USA.

Funding: Esther H. Chen, MD, receives 10% FTE support from the dean's office to lead the pay-for-performance improvement program.

Conflict of interest: The authors declare they have no competing interests.

The authors would like to thank Alanna Labat, program analyst, for collating the monthly data and Lukejohn Day, MD, for his support of the resident and fellow incentive program.

Corresponding author: Esther H. Chen, MD, Zuckerberg San Francisco General Hospital, San Francisco, California, USA, esther.chen@ucsf.edu

Received January 13, 2024; revisions received April 12, 2024, and May 13, 2024; accepted May 20, 2024.