



# Use of a Patient Visit Tracker Tool to Advance Experiential Learning in Systems-Based Practice and Quality Improvement in a Medical Student Clinic

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**Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School**

**Date:** 30 October 2015

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**Scholarly Report Title:** Use of a Patient Visit Tracker Tool to Advance Experiential Learning in Systems-Based Practice and Quality Improvement in a Medical Student Clinic

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**TITLE:** Use of a Patient Visit Tracker Tool to Advance Experiential Learning in Systems-Based Practice and Quality Improvement in a Medical Student Clinic.

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**Purpose:** Poorly designed healthcare systems increase costs and preventable medical errors. Systems-based practice (SBP) education allows physicians to identify systemic errors and implement quality improvement (QI) initiatives. Here we describe this experiential learning in a medical student-faculty collaborative practice (MSFCC), which challenged medical students to identify inefficiencies, implement interventions, and track the results.

**Methods:** In order to enhance medical students' understanding of SBPs and QI, we identified patient wait times as an area for improvement. We designed an electronic Patient Visit Tracker dashboard to track the status of each patient's visit and calculate total time and wait times, and implemented interventions based on the results to further streamline the clinic flow.

**Results:** A comparison of clinic times prior to and following the intervention period revealed that the mean total time and the visit time decreased significantly. Other components such as student history-taking time showed a trend toward reduced delays but were not statistically significant. These results suggest that the interventions may have improved clinic flow without sacrificing patient time with the healthcare team.

**Conclusions:** Our model allowed students to drive their own active learning in a practical clinical setting, providing early and unique training in crucial QI skills.

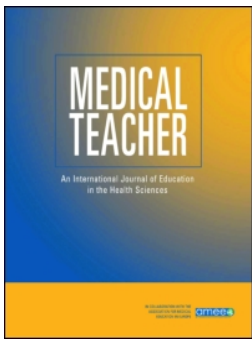
I joined the Crimson Care Collaborative (CCC) research team at Beth Israel Deaconess Medical Center (BIDMC) in the fall of 2012. Earlier that year (spring 2012), the Patient Visit Tracker platform had been designed and implemented into the clinic workflow. This work was mainly completed by several of the co-authors on the manuscript, who were either former senior directors of CCC-BIDMC (John Hegde, Mitalee Christman, Sun Yoo, Tomi Jun) or former directors of operational strategy (Alisa Yamasaki and Aaron Berhanu). The data used for the manuscript was generated from 19 clinic sessions from February to July 2012.

Upon joining the team, my primary responsibilities were to organize the data, run the analysis, create the figures, draft the manuscript, and prepare the work for submission. Working together with Ryan Park (second author on the manuscript and another Harvard Medical School student), I analyzed the data and generated the figures and figure legends, and then drafted a manuscript for submission to the journal *Medical Education*. This draft was edited extensively by Ryan and the physician co-authors who were involved with the CCC-BIDMC leadership at the time (Drs. Pamela Vohra-Khullar, Kristin Remus, Amy Weinstein). We also asked Dr. Richard Schwartzstein for feedback given his expertise in the area of medical education. Unfortunately, our submission was rejected from *Medical Education* due to its focus on research methods rather than on quality improvement and medical education initiatives. Therefore, I worked extensively with Ryan and Dr. Schwartzstein to re-model the manuscript from a quality improvement and systems-based practices angle. I re-drafted the manuscript, and after another round of edits by Ryan, the CCC-BIDMC leadership, and Dr. Schwartzstein, I re-submitted the manuscript to the journal *Medical Teacher*. I was then responsible for incorporating the revisions requested by the editors. After a final round of edits, the manuscript was accepted for publication.

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## How we used a patient visit tracker tool to advance experiential learning in systems-based practice and quality improvement in a medical student clinic

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## HOW WE...

# How we used a patient visit tracker tool to advance experiential learning in systems-based practice and quality improvement in a medical student clinic

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## Abstract

Poorly designed healthcare systems increase costs and preventable medical errors. To address these issues, systems-based practice (SBP) education provides future physicians with the tools to identify systemic errors and implement quality improvement (QI) initiatives to enhance the delivery of cost-effective, safe and multi-disciplinary care. Although SBP education is being implemented in residency programs and is mandated by the Accreditation Council for Graduate Medical Education (ACGME) as one of its core competencies, it has largely not been integrated into undergraduate medical education. We propose that Medical Student–Faculty Collaborative Clinics (MSFCCs) may be the ideal environment in which to train medical students in SBPs and QI initiatives, as they allow students to play pivotal roles in project development, administration, and management. Here we describe a process of experiential learning that was developed within a newly established MSFCC, which challenged students to identify inefficiencies, implement interventions, and track the results. After identifying bottlenecks in clinic operations, our students designed a patient visit tracker tool to monitor clinic flow and implemented solutions to decrease patient visit times. Our model allowed students to drive their own active learning in a practical clinical setting, providing early and unique training in crucial QI skills.

## Introduction

Attention to and changes in systems-based practices (SBPs) are important components of efforts to improve patient care, quality, and outcomes while reducing cost and waste (Johnson et al. 2008). Following studies that have shown that 1.5 million medical errors are made in United States (US) hospitals every year (Van Den Bos et al. 2011; James 2013), the medical community has recognized the importance of integrating teaching about and experience with SBPs into medical training, with the goal that healthcare providers understand how individual practices are integrated into larger systems of care, and how these systems can be reformed for quality improvement (QI) (AAMC 2014a).

While medical students gain both didactic and experiential exposures to core competencies (AAMC 2014b) and patient care during their pre-clinical years, they currently receive little exposure to SBPs beyond classroom lectures and readings (Hostetter 2010). Medical students are provided with valuable, but brief opportunities to experience SBPs in the hospital during their clerkships (Rivo et al. 2004); however, they are usually unable to drive QI initiatives in this setting, since they frequently rotate quickly from one service to another (Hostetter 2010), resulting in limited opportunity for

experiential teaching in SBPs prior to residency. Only 34.7% of graduating medical students who responded to the 2013 Association of American Medical Colleges (AAMC) Medical School Graduation Questionnaire reported receiving adequate instruction on healthcare systems in medical school (Association of American Medical Colleges 2013).

Teaching about SBPs is often done through brief seminars, courses, and lectures rather than through active, integrated learning (Johnson et al. 2008). This is contrary to decades of research on adult learning and development that have shown that the process of learning should be conceptualized as a dynamic, holistic, and integrated process that involves both the individual and the environment. David Kolb's experiential learning theory, which integrates the work of several foundational experiential learning scholars and has significantly influenced management learning and development, posits that learning in higher education should be a process that engages students to experience, reflect, think, and act on immediate or concrete experiences with feedback on the effectiveness of their learning efforts (Kolb & Kolb 2008). Therefore, medical student education regarding optimal SBP practices may be more effective in a practical setting rather than a classroom environment.

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Medical student–faculty collaborative clinics (MSFCCs) are an elegant solution for active, holistic, and integrated experiential training in SBPs during medical school. In 2007, 49 out of 124 AAMC allopathic schools in the US had at least one student-run clinic (Simpson & Long 2007), making them a growing option for real-world medical student education. These clinics bring together medical students and physician faculty members to provide access to primary care services for patients, who are typically underinsured or indigent. Medical students play pivotal roles in all aspects of the administration and management of the clinic (Berman et al. 2012), including coordinating patient appointments, directing patient flow during clinic work hours, and staffing social services and laboratory centers. In MSFCCs, medical students are responsible for clinic logistics and daily operations while providing patient care with faculty oversight. Since these clinics allow medical students to obtain hands-on experience in clinic operations and management, they are well-positioned to create a process-based framework for training medical students in implementing QI initiatives. Our pilot project, Patient Visit Tracker, demonstrates how an MSFCC challenged medical students to engage in SBPs by identifying inefficiencies, proposing solutions, implementing interventions, and tracking the results. Thus we show that MSFCCs can be used as a platform for students to engage in active experiential learning and SBP training.

## What we did

As our primary goal was to enhance medical students' understanding of SBPs and QI processes through experiential training in a MSFCC, we sought to identify opportunities for process improvement. Senior directors of the clinic, who are fourth year medical students, found that sub-optimal scheduling and bottlenecks in clinic flow were causing patients to wait unnecessarily long before and during their visit. To address these problems, the students proposed an idea for an electronic dashboard to track the status of each patient's visit and thereby monitor clinic flow and identify potential systems issues contributing to delays.

Our students researched computerized patient trackers and found evidence that the replacement of traditional handwritten logs with computerized trackers improves clinic efficiency and diagnostic accuracy (Nkoy et al. 2008), partly by allowing providers access to real-time updates of patient information and the current stage of the patient visit (Drazen & Rhoads 2011). Previous research found that the implementation of electronic patient trackers minimized delays, significantly improved communication, and significantly decreased the total time patients spent in the clinic (Borowitz 1996; Maloney et al. 2007).

By designing and using an electronic patient tracker to monitor the status of each patient as they progressed through their clinic visit, medical students in our MSFCC were able to identify areas for operational improvement, introduce operational changes, and measure the impact of those changes.

## Setting

Crimson Care Collaborative at Beth Israel Deaconess Medical Center (CCC-BIDMC) is a MSFCC that is available to patients in a weekly evening session and consists of six clinical medical student teams, each made up of one “junior clinician” (first- or second-year medical student) and one “senior clinician” (third- or fourth-year medical student). Patients book appointments for a one-hour visit in which they will be seen initially by a team of students, followed by an attending physician. Two attending physicians serve as preceptors and staff each clinic session. Operational responsibility for the clinic is situated primarily with senior medical students (“Senior Directors”), who recruit patients, set clinic schedules, develop educational materials for individual patients and counseling sessions, and run all recruitment, training, and management of medical, nursing, and pharmacy students who provide patient care. Student-run committees and focus groups also meet at regular intervals throughout the year to ensure that the clinic is running smoothly and to discuss initiatives that can increase clinic efficiency and efficacy.

## Patient Visit Tracker design

The members of CCC-BIDMC began data collection by designing the Patient Visit Tracker. Utilizing standard spreadsheet functionality with free, commercially available, online software (Google Drive, Google Inc., Mountain View, CA), students created the Patient Visit Tracker, which was prominently displayed in the clinic workroom to track the progress of each patient's visit in real-time. Each patient was de-identified and listed in one column. Each visit component was listed in one row. During the visit, a medical student administrator entered the time of patient check-in, clinical medical student team exam start/end, physician preceptor presentation start/end, and the time that the patient left the clinic into the spreadsheet in order to track clinic flow. The spreadsheet was programmed to automatically calculate the total time each patient was present in the clinic (total time), the time each patient spent waiting before and during their visit, and the time each patient spent during the visit after initial clinician contact (visit time). While the primary purpose of collecting these data was for use in retrospective data analysis (to identify bottlenecks and design and evaluate interventions), the fact that this information was displayed prominently in the work room made the Patient Visit Tracker itself an intervention, as it enabled every staff member to proactively identify patients whose visits were taking excessively long and to respond in an effort to improve the flow of care. Clinicians and student administrative staff quickly embraced the Tracker, likely due to its prominent display and clarity. The platform could be accessed from any computer or Internet-enabled device in the clinic and updated in real-time across all devices, allowing every member of the clinical staff to ascertain the current status of each patient visit at all times.

## Data evaluation

Data were collected during 19 clinic sessions from February to July 2012. The following elements were monitored: patient

check-in time, wait time after patient check-in, time spent with junior/senior medical student team, wait time between seeing the medical student team and the physician preceptor, time spent with physician preceptor, and total visit time. At the outset, the goal of the CCC-BIDMC practice was to complete patient visits in 60 minutes, with the student history-taking portion lasting approximately 25 minutes and the time with attending lasting an additional 20 minutes; this schedule allowed 10 minutes for the students to subsequently conclude the appointment. Based on the clinic flow data from early 2012, visit components lasting longer than desired were identified. Senior directors and faculty members in the practice observed clinic flow and worked together to develop operational changes to decrease these times. These changes included (1) standardizing the amount of time dedicated to work-up of the patient by the student clinician teams, (2) training student clinician teams to conduct more efficient histories and physicals by providing history templates and encouraging focused exams; this was especially useful for the student clinicians as many of them were in their first two years of medical school and had not yet experienced clinical clerkships; (3) implementing a paging system to help keep student clinician teams and faculty physicians on schedule, (4) encouraging attending physicians to interrupt student teams that went beyond the allotted time, (5) initiating team huddles prior to clinic start to help students anticipate key issues to be addressed in the visit and thereby streamline their patient care, and (6) optimizing the time at which patients were given forms for educational, QI, research, and clinical purposes (e.g., in the waiting room before the beginning of the visit rather than at the end of the visit). Announcements were made prior to the start of clinic to regularly remind students of the changes. These changes were implemented over a nine-week intervention period.

A comparison of clinic times during the four weeks prior to the intervention period (pre-intervention period, 2/21/12–3/20/12) and the four weeks following the intervention period (post-intervention period, 6/5/12–7/3/12) revealed that the mean total time that patients spent in the clinic and the visit time decreased significantly. Wait times during the clinic visit showed a trend towards reduced delays but the changes were not statistically significant. Importantly, time with attending and student history-taking time did not decrease significantly, suggesting that the interventions may have improved clinic efficiency and reduced the time patients spend at our clinic without sacrificing patient time with the healthcare team (Table 1).

## What we learned

MSFCCs can place medical students in an ideal position to integrate operations management and patient care. Our clinic provides students with the opportunity to engage with SBP principles and design processes of care first-hand; Patient Visit Tracker allowed students to create solutions for inefficiencies in clinic operations using principles of root cause analysis. By mapping out all the elements of the clinic visit from patient arrival to the end of the clinical encounter with Patient Visit Tracker, our medical students were able to identify bottlenecks in the system, propose solutions, and then test the efficacy of their interventions. The intervention was well received by our students and has been incorporated into the clinic's operational model. By implementing a learning cycle that is driven by concrete experience, reflection, action, and feedback, our system allowed medical students to work through a QI process, implement changes, and assess the impact of the changes in a plan-do-study-act (PDSA) cycle (Berwick 1998). Utilizing the MSFCC in this way, we provided an educational opportunity for medical students to experience both the process of identifying areas for QI and the framework for implementing and measuring the results of these revised systems of care.

Our study builds upon past findings that patient tracker software can improve patient flow (Borowitz 1996; Maloney et al. 2007; Nkoy et al. 2008). We found that identifying areas of concern with Patient Visit Tracker and implementing operational changes yielded statistically significant decreases in visit time and total time that patients spent in the clinic without sacrificing time spent with providers. More importantly, our study demonstrated that MSFCCs can be used as a practical tool to teach medical students about SBPs. The setup of an MSFCC, which allows medical students to take a large portion of the responsibility of the administration of the clinic, provides the flexibility for students to make changes to clinic management and day-to-day operations. These experiences allow students to engage in experiential learning and QI in a real, practical environment: medical students design interventions through student-run committees, focus groups, and Board and Senior Director meetings (plan), implement those interventions during weekly clinics organized and run by medical students (do), administer surveys and collect and analyze data in student research teams overseen by a faculty member (study), and modify interventions based on the results of that data as early as the following week (act). Thus, our model can provide valuable hands-on management and SBPs training rarely found elsewhere in medical school. In addition,

**Table 1.** Time spent at each component of the clinic visit by patients' pre- and post-intervention.

	Pre-intervention (min)	Post-intervention (min)	Change (%)	<i>p</i> -value
Total time	81.6	63.8	–21.9	0.02*
Visit time	77.2	60.9	–21.1	0.02*
Wait #1	4.5	2.9	–35.9	0.25
Student history taking	31.1	27.2	–12.6	0.18
Wait #2	9.6	8.2	–14.4	0.78

*p*-value calculated using Student's *t*-test with Welch's correction.  
\**p* < 0.05.



this model could be generalizable to medical schools without MSFCCs by having students incorporate similar systems-based practice experiences in their longitudinal primary care courses, which often extend over many months.

## What's next

Patient Visit Tracker is currently being developed as a stand-alone web portal with additional features for more robust data input and analysis, including automatic time-stamping, a mobile app with built-in authentication to allow any clinic staff member to input data and monitor the status and location of all patients, and analysis tools that predict upcoming bottlenecks based on patient appointment and check-in times. Developing a mobile app and a stand-alone web portal would enable us to disseminate this tool to other clinics, including several MSFCCs that have already indicated interest in the dashboard after learning of it (Jun et al. 2013). In addition, in order to better inform clinic staff on patient and medical student responses to the implemented interventions, surveys will be developed and distributed to both patients and medical students in the clinic to assess satisfaction with clinic flow and wait times.

## Conclusion

Mounting evidence suggests that training healthcare providers in SBPs can lead to both valuable learning opportunities and better patient outcomes (Mohr et al. 2003; Delphin & Davidson 2008; Nabors et al. 2011). However, much of the current literature describes SBPs implemented at the residency level; to the best of our knowledge, no SBP teaching tools have been targeted towards medical students. We believe that SBP training should be integrated into every part of the medical education continuum, beginning with medical school. Our experience illustrates that MSFCCs can serve as an opportunity to teach medical students about the implementation and evaluation of actionable QI initiatives, addressing an important gap in system-based practice education prior to entering residency.

## Notes on contributors

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Former HMS students, JOHN V. HEGDE, MD; MITALEE P. CHRISTMAN, MD; and SUN M. YOO, MD MPH, are currently residents.

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