Impact of a Student-Faculty Collaborative Primary Care Clinic on Emergency Department Utilization: Shifting the Discussion Towards Value-Based Healthcare

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<th>Citation</th>
<th>Thakkar, Anjali Thakkar. 2017. Impact of a Student-Faculty Collaborative Primary Care Clinic on Emergency Department Utilization: Shifting the Discussion Towards Value-Based Healthcare. Doctoral dissertation, Harvard Medical School.</th>
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Title Page
Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School
Date: 03/29/17
Student Name: Anjali Thakkar, BS
Scholarly Report Title: Impact of a Student-Faculty Collaborative Primary Care Clinic on Emergency Department Utilization: Shifting the Discussion Towards Value-based Healthcare
Mentor Name(s) and Affiliations:
Bonnie B. Blanchfield, Sc.D., Department of Medicine, Brigham Health
Collaborators, with Affiliations:
Pooja Chandrashekar, Harvard College
Student Contribution:

I led and implemented this study, working full-time during November, December, and January, and part-time during February and March. I have been mentored by Dr. Bonnie Blanchfield since June to develop and refine the research question. I subsequently led the process of conducting a thorough literature review and planning out the project, incorporating Dr. Blanchfield’s feedback and suggestions. After defining the target patient population and variables of interest, I requested and obtained raw data and created a dataset. I then conducted descriptive, financial, and statistical analysis. To conduct a regression model, I worked with Harvard Catalyst to get access to a statistician, and worked with her to provide all necessary data and model planning. I presented this work at three conferences: the national Society of General Internal Medicine conference, the New England regional Society of General Internal Medicine conference, and the Society of Student-Run Free Clinics conference. Finally, I wrote this manuscript with Dr. Blanchfield’s mentorship, and plan to submit it for publication in Academic Medicine. I will also lead the post-submission editing process as necessary.
Abstract

TITLE: Impact of a Student-Faculty Collaborative Primary Care Clinic on Emergency Department Utilization: Shifting the Discussion Towards Value-based Healthcare

Anjali Thakkar, Pooja Chandrashekar, Bonnie Blanchfield

Purpose: Student-run clinics (SRCs) provide primary care access to low-income patients who otherwise would pursue more expensive care such as visits to emergency departments (ED). Decreasing inappropriate ED utilization offers a major opportunity to create value in the health care system. To date, no SRC has rigorously studied this. We hypothesize that increased access to ambulatory care through the Crimson Care Collaborative (CCC), a student-run clinic, is associated with decreased ED utilization, providing value to both providers and payers justifying the investment in SRCs.

Methods: A five-year retrospective analysis was conducted to determine if ED utilization changed after patients enrolled in CCC. Patient level ED visit data was used to estimate the average change in ED utilization. A regression analysis examined the impact of demographic and clinical variables on change in ED utilization.

Results: Average per patient ED utilization significantly (p<0.01) decreased by 28%, 40%, and 48% for patients enrolling in CCC from 2013-2015, respectively. Regression analysis revealed that for each additional visit to the CCC clinic, ED utilization per patient decreased by 0.44. This decrease translates to 41 avoided ED visits annually, and estimated payer savings of $51,812, approximately 41% of the clinic’s operating budget.

Conclusions: CCC created value to payers and the provider from 2013-2015 by providing an alternative source of care, and increasing capacity in the hospital ED for more acute emergent and appropriate care. This study suggests that SRCs can create financial value to society, and initiate a shift in the medical education conversation toward value-based care.
Introduction

The ongoing national conversation about healthcare costs has led to a dramatic shift in US healthcare policy toward reimbursement structures that incentivize high quality, efficient care, thus shifting the focus from volume to value. In this rapidly changing healthcare delivery and policy climate, utilization of scarce resources must be justified by proving value to patients, providers, and policymakers. Value in healthcare has been defined as outcomes divided by cost, with the best cost savings interventions shifting the balance between more expensive and less expensive services while maintaining high quality outcomes.(1,2)

Although student-run clinics (SRCs) are resource-intensive programs to the academic centers that support them, they have been largely immune from budget cuts despite changes to reimbursement structures. A survey-based study by Smith et al in 2007 found that of 49 SRCs in existence at the time, 27 disclosed finances; the mean annual operating budget, $18,889 (SD ± $19,205), with a range from $500 to $95,000, was based on widely different service offerings.(3) Since then, the number of SRCs has grown significantly, with 96 registered SRCs in 2016. Additional financial information, however, is not available.(4)

Several studies have justified resource utilization of SRCs by demonstrating the educational value they provide to health professional students who volunteer in various clinical and non-clinical roles.(5–9) Sources of value include improved clinical skills and self-efficacy, opportunities to teach and mentor, improved attitudes toward working with underserved patients, and increased interest in primary care.(5–9) While educational value is important and increased interest in primary care can positively impact the US primary care shortage, we posit that SRCs must also be held to standards that encourage value of care to patients and health systems. In fact, such standards can reinforce the educational and recruitment value gained from student involvement in SRCs by fostering a culture of accountability, such as through justifying investment in operating SRCs.

Significance and Aims

It is well-established that many student-run clinics (SRCs) provide primary care access to low-income, uninsured patients who otherwise would pursue more expensive avenues of care such as visits to emergency departments (ED).(10) According to a study by the American Hospital Association, the number of ED visits grew by 41 million (46%) between 1991 to 2011, while the number of hospitals with operational EDs decreased by 647 (~15%) during the same time period.(11) Furthermore, 32% of teaching hospitals reported EDs that were over capacity, resulting in diversion status 38% of the time.(11) The top two reasons cited for going on diversion were lack of critical care or monitored beds (42%) and ED overcrowding (27%).(11) Despite this worsening supply-demand mismatch, a report found that 66% of ED visits by commercially-insured patients were either non-urgent (requiring attention within 12
hours) or could be effectively addressed in an outpatient primary care practice.(12) Another study estimated that 13-27% of US ED visits could be managed by primary care providers with estimated annual savings to the system of $4.4 billion.(10) Furthermore, it is well-established that non-emergent emergency department visits could be reduced by developing a relationship with a regular doctor, regardless of socioeconomic and health status factors.(13–15) Thus, decreasing inappropriate ED utilization offers a major opportunity to create value in the health care system.(10)

Despite the obvious need for decreased ED utilization, few SRCs have rigorously studied this using hospital data.(16) An SRC in Nashville, TN, surveyed new and returning patients, and found a significant decrease in self-reported ED use and easier access to physicians.(17) However, this study compared patient-reported, rather than actual hospital data for rates of ED use; furthermore, they compared aggregate data, rather than paired patient data, of ED utilization before and after joining an SRC. Two studies at free clinics that do not appear to be student-run found a significant decrease in ED utilization; however, given the many unique characteristics and limitations of a student-run model, it is difficult to extrapolate value implications for SRCs from these studies.(18,19)

To address this gap, we studied the value created by the Crimson Care Collaborative (CCC), a network of student-run clinics providing primary care services at six locations in the Greater Boston area. Many patients utilizing the CCC clinics do not have primary care access, and are anecdotally thought to be higher users of ED services. We quantified the value created to payers and providers by identifying the change in ED utilization before and after patients enrolled at the CCC clinic at Massachusetts General Hospital-Internal Medicine Associates (MGH-IMA). We estimated the dollar value savings to the health care system, measured as reduction in payments by payers to providers, and explored the relationship of other covariates that may have impacted the change in ED utilization. We hypothesized that increased access to ambulatory care through CCC would be associated with decreased ED utilization. Decreasing ED utilization could potentially reduce losses generated by under-reimbursed services and create capacity in the ED for appropriate cases, netting increased margins or cost savings to the provider, depending on payer mix, and justification for the SRC model.

This study will begin to answer the unanswered question: Can SRCs create value by reducing ED utilization? Through this study, we aim to shift the dialogue at SRCs toward value-based care to create a culture of resource consciousness and accountability in decision-making/

Methods

A retrospective longitudinal analysis was conducted to determine if ED utilization changed after patients enrolled in a CCC clinic and had access to primary care.

Setting
The CCC-IMA clinic is a student-run clinic at the MGH-IMA adult medicine primary care clinic. It was piloted as the first CCC site in 2010, and subsequently was established in 2011. The clinic operates from 5:30pm to 7:30pm on Tuesday nights for 49 weeks during the year: for 39 weeks, the clinic schedules 7 to 10 patients per night; for 10 weeks during the summer, the clinic operates at half capacity. Four student teams comprised of junior and senior medical students are supervised by two primary care physicians per clinic night. Residents rotating through the clinic supplement the learning environment with didactic teaching sessions. The clinic serves as a longitudinal bridge to care clinic for a subset of patients, as well as a supplemental after-hours urgent care clinic for other patients since wait times at the IMA after-hours urgent care clinic are usually long. In addition to primary care, student clinicians provide social services to patients.

**Study Population**

The study population included all 697 adult patients who enrolled at the CCC MGH-IMA clinic over the five fiscal years between October 1, 2010 and September 30, 2015. Partners Healthcare employees were excluded from the study. Annual patient cohorts, consisting of newly enrolled CCC patients, were created for each fiscal year, 2011-2015.

**Data**

*Sources:* All patient data was obtained from the Research Patient Data Registry (RPDR), the internal centralized clinical data registry/warehouse that gathers data from hospital medical records and other systems. The number of outpatient CCC visits per patient post-enrollment in the SRC and self-reported socioeconomic status data were obtained from a RedCap database, a secure data management system in which students input and manage patient data during weekly clinic sessions.

*Extrapolated data:* Self-reported socioeconomic status data was incomplete; thus, it was approximated using the mean per capita income for the patient’s home zip code. Distance from a patient’s home to the clinic was calculated as the distance from the center of the patient’s home zip code to the CCC-IMA clinic. Clinical health status was defined as the sum of the presence or absence of the following 11 conditions: asthma, hypertension, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, diabetes, thyroid disease, arthritis, anxiety, depression, and hyperlipidemia.

*Outcomes:* The primary dependent outcome of interest was defined as the change in ED utilization before and after enrollment in CCC. Using RPDR ED data, the aggregate and average number of annual ED visits was calculated for each patient in each cohort. The 18 months, pre- and post-enrollment in CCC, were used to estimate the average change in ED visits after CCC enrollment for patients enrolling between 2011-2015.
**Other Covariates:** Independent variables included gender, age, language, race, distance to clinic, marital status, payer, socioeconomic status, smoking status, body-mass index, health status, and outpatient clinic utilization.

**Descriptive Analysis**

Descriptive analyses were used to characterize the annual patient cohorts demographically, socioeconomically, and clinically.

**Bivariate and Multivariate Analyses**

Two-sided Wilcoxon Signed rank tests were estimated to determine if the changes in ED utilization post-enrollment in CCC were significant.

Multivariate analysis was used to explore the influence of the following independent covariates on change in ED utilization: gender, age, primary language, race, socioeconomic status, marital status, distance to CCC-IMA clinic, insurance type, smoking status, BMI, health status, and annual number of CCC outpatient visits per year. SAS V9.4 PROC ROBUSTREG was used to fit the model. Statistically significant results (p<0.05) were noted.

**Financial Analysis**

Internal financial data, including net revenue, direct costs and total costs, was obtained and reviewed for all MGH ED visits (CCC and non-CCC patients) during fiscal years 2014 and 2015 from the Partners Healthcare’s internal cost accounting system, EPSi. However, to ensure more generalizable results and to protect the confidentiality of internal costs and revenue, National Institutes of Health (NIH) estimates of median ED visit costs during fiscal years 2006-2008, were used to estimate cost savings.(20) We multiplied the median ED visit cost (reimbursement paid to providers) by the number of avoided visits per year to calculate annual cost savings. Avoided visits were calculated by determining the average annual per patient reduction in ED utilization, and multiplying by the average annual cohort size. Results estimate the reduction (or increase) in payments by the payers to the provider. To understand the relative financial impact of these savings to the CCC clinic, annual savings were divided by the annual operating budget for the CCC-IMA clinic, obtained from the clinic’s financial manager. This study was approved by the Partners Healthcare Institutional Review Board.

**Results**

The demographic characteristics of 697 patients seen by the CCC-IMA clinic between 2011-2015, are summarized in Table 1. Of note, 47% of all patients were male; 25% were over the age of 65; 64% self-identified as white; and 85% spoke English as a primary language. Addresses ranged between 1 and 216 mile-radius of clinic, with 71% living within a 10-mile radius of the clinic. Nearly half of all patients, 49%, were commercially insured, 27% were covered by Medicaid, 19% were covered by
Medicare, and 5% were uninsured. The majority of patients, 66%, had an annual per capita income between $15,000 and $40,000.

The clinical characteristics of the patient cohort is summarized in Figure 1. The majority of patients had between two and four chronic conditions, with hyperlipidemia being the most commonly represented condition.

**ED utilization by cohort**

Notably, between 2011 and 2012, average ED utilization per patient increased by 15% (p=0.23) and 52% (p<0.05), respectively, despite CCC access. During the subsequent three annual cohorts, 2013-2015, average per patient ED utilization significantly decreased (p<0.01) by 28%, 40% and 48% respectively. On a per patient basis, average annual ED utilization decreased by 0.26 visits per year. These results are summarized in Figure 2.

Regression analysis controlling for 12 demographic and clinical characteristics revealed that for each additional visit to the CCC outpatient clinic, ED utilization significantly decreased by 0.44 per patient (p<0.001). Aside from outpatient clinic utilization, no other demographic or clinical characteristic was significantly related to the change in ED utilization.

**Financial impact**

Median ED visit cost was estimated to be $1,233 based on an NIH study of the cost of ED visits for the ten most common diagnoses.(20) Based on utilization analysis results of reduction in 0.26 visits per patient per year, and average annual cohort size of 158 patients (average of cohort sizes from 2011 to 2015, excluding 2013 which was an outlier), 41 ED visits were avoided each year, amounting to $51,812 in annual provider (MGH) savings. Annual CCC-IMA operating budget was estimated to be $123,000, and savings to MGH amounted to an estimated 41% of the clinic’s operating budget.

**Discussion**

The observed decreases in ED utilization after enrollment in CCC noted among the 2013, 2014 and 2015 cohorts, suggest that patients will seek outpatient care rather than ED care if available. Although we did not study the reasons for shifting their care specifically, we observed a significant relationship with use of the CCC clinics.

The significant increase in ED use observed in the 2012 cohort is puzzling. We assume this increase was due to low patient engagement, anomalous patient recruitment trends, and clinic leadership turnover. Since the clinic was only in its second year of operation, it is possible that patient engagement was low due to poor awareness about the clinic and its offerings. High student-volunteer turnover may have led to temporary halting of time-intensive initiatives around patient engagement and education. Additionally, in January 2013, one of the two attending physicians left the institution; the resources
required to recruit and train a new attending, and pass forward institutional knowledge in anticipation of this turnover may have compromised patient engagement and education initiatives. Second, since the clinic depends on patient referrals from the ED or urgent care overflow, it is possible that the patients referred to CCC-IMA in 2012 had a greater tendency towards ED use. Finally, some contribution to the ED utilization trend at CCC-IMA may be attributable to Massachusetts-wide macro trends in ED utilization. The 2015 Health Policy Commission report found that ED utilization increased from 2011 to 2012, and then subsequently declined from 2013 to 2015—a similar trend observed in our study. \(^{(21)}\)

The results of our study are notable for two key reasons: first, understanding drivers of ED utilization can facilitate targeted quality improvement initiatives to improve clinic efficiency; and second, quantification of the value created for multiple stakeholders provides justification for the SRC model.

**Quality Improvement**

The observed relationship between increased outpatient clinic use and decreased ED utilization creates the opportunity for targeted quality improvement (QI) initiatives to enhance this inverse relationship. For example, piloting a patient education initiative to educate patients around appropriate use cases for the ED could lead to increased outpatient clinic use and even lower ED use. A patient engagement initiative seeking to connect with patients more frequently to enhance patient-provider relationships could similarly result in greater shifts toward care in the appropriate setting. Currently, patients are recruited through the MGH ED or IMA urgent care clinics, but there are no programs in place to encourage patients to remain engaged with their care provider. Given the observed relationship in this study, it may be cost-effective to incent patients to engage more frequently with the outpatient CCC clinic to further reduce ED utilization.

A key next step in this analysis should aim to understand the specific reasons for patient visits to the ED and the outpatient clinic. This could drive disease-specific initiatives to address the underlying drivers for inappropriate ED use and insufficient outpatient clinic use.

Although CCC does not reap the benefits of financial savings from decreasing ED utilization due to its operating structure, such analyses could provide clinical justification for budget increases to facilitate QI initiatives. Just as provider organizations shifting toward accountable care organization models are re-investing savings into population health management and wellness programs, likewise CCC can re-invest additional resources into enhancing its engagement and recruitment models. Alternatively, investment in recruiting additional staff and faculty support to expand clinic capacity can magnify the degree of savings.

**Value for Society**

In the current healthcare climate where costs are out of control, resource utilization must be justified by incremental value. Quality and education may not be enough. Our study suggests that CCC
created value to both payers and the provider from 2013-2015 by providing an alternative source of care and reducing ED visits. Although the savings to payers are obvious and easy to identify vis-à-vis reduction in payments to providers for avoided ED visits, providers also save money as a result of reduced utilization. We are assuming that reductions in ED visits reflect shifts of non-urgent care from the ED to the outpatient clinic. When this occurs, care is provided in a lower cost setting (outpatient clinic) and the ED capacity increases. This creates an opportunity for providers to care for more appropriate and likely more resource-intensive patients. Additionally, given the supply-demand mismatch resulting in diversion in most EDs in the Greater Boston area, freeing up ED capacity enables MGH to treat urgent patients in the ED who actually require ED-level services. In addition to delivering better care to these patients, such high-acuity cases could be higher revenue-generating episodes yielding greater profits, dependent on the payer mix.

Although not explicitly studied, CCC likely also created value to patients by providing expedient care in the appropriate setting. During the visit, patients are given the option to continue receiving care at CCC-IMA or bridging to care at the MGH-IMA host clinic, thus enabling patients to establish a physician relationship. As mentioned previously, studies show that patients who have a relationship with a regular doctor are less likely to use the ED for non-urgent complaints. CCC also provides patients with additional services, such as social services and co-located behavioral health; moreover, since CCC operates in the evenings, patients are able to access after-hours care, reducing job absences and creating a larger primary care base for the hospital. Such financial savings from preventing absences at work for employed patients could not be quantified.

Finally, such studies also provide value to medical students who volunteer at SRCs by providing an educational platform to learn about value-based care and resource-consciousness. Medical school is the ideal time to educate young physicians about the complexities of shifting payment and incentive models, and to create accountability around the value of care they deliver; such an understanding can not only cultivate positive attitudes toward resource consciousness, but also enhance the future workforce’s ability to transition to a value-driven environment. For example, rather than being reactive, it can create a culture where physicians proactively seek ways to maximize quality while minimizing resource utilization and justifying their use. However, education around value-based care is limited in most medical education curricula. Recently, the AMA published a new textbook on value-based care, which will be piloted at 32 medical schools around the country; given that nearly 100 medical schools host SRCs, they offer an ideal setting in which to put theoretical knowledge to work.

Limitations

There are some limitations to our study that should be highlighted. First, due to data accessibility, we only examined ED utilization within the Partners Healthcare system. Patients may have visited EDs
outside the system, which cannot be accounted for in our analysis. However, given Partners’ expansive network within Massachusetts, we believe the results of our study account for the majority of our patients’ ED usage.

Second, this study did not address reasons for ED visits to determine whether they were urgent or non-urgent. As a result, we are unable to draw conclusions about the type of ED visits that were avoided, but assume that enrollment in CCC shifted non-urgent care to the appropriate setting. The relationship observed in the regression analysis that ED utilization decreased as outpatient visit use increased supports this assumption.

Finally, it is interesting to note that the number of patients seen in the outpatient clinic declined over time from 2011 to 2015, despite the inverse relationship between ED utilization and frequency of outpatient visit. Given the limited number of operating hours at CCC-IMA, we examined utilization of the clinic relative to its capacity. Capacity utilization, defined as actual CCC outpatient visits divided by potential CCC outpatient visits, is shown in Figure 3. Utilization of the clinic appeared to be high in year one (63%) with a subsequent decline over the next five years. This, combined with the observed relationship between ED utilization and outpatient clinic use, suggests that only a small number of patients may have been using the clinic more frequently in the later years. Alternatively, this lower capacity utilization may be attributable to higher no-show rates. The nadir in 2013, when capacity utilization was lowest at 34%, can be explained by a structural change in the clinic at the time. As described earlier, one attending physician left the institution in 2013, and several of her patients who had enrolled in CCC during the two prior years moved to her new institution, located within the same city. Simultaneously, new patient recruitment was slower than normal, evidenced in the low number of new enrollees in 2013, as the clinic was searching for a replacement attending to maintain capacity. Further subgroup analysis for each cohort could shed light into the drivers for the observed relationship between ED and outpatient clinic utilization.

**Conclusion**

While CCC operates at six community sites, this pilot study only examined the change in ED utilization at one of six CCC clinic sites. Given the different patient populations, location, payer mix, and most common chief complaints at the various CCC sites, it is difficult to extrapolate value across the organization based on the results of this study. A broader, CCC-wide study should be undertaken to assess the financial savings achieved through reduction in ED utilization across all clinic sites.

This study is the first, to our knowledge, to study the impact of SRCs on ED utilization, and to address the question of whether they create financial value. More importantly, our approach is a proof-of-concept that SRCs can be positioned as a platform for teaching students about value and resource
consciousness in healthcare delivery. By shifting the dialogue at SRCs toward value-based care, we aim to not only justify resource utilization and drive quality improvement, but also to train future physicians to understand and advance our changing healthcare landscape.
Table 1. Demographic characteristics of annual CCC patient cohorts enrolling between 2011 and 2015.

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<td>341</td>
<td>49%</td>
<td>73</td>
<td>44%</td>
<td>83</td>
<td>54%</td>
</tr>
<tr>
<td>Commercial</td>
<td>38</td>
<td>5%</td>
<td>13</td>
<td>8%</td>
<td>7</td>
<td>5%</td>
</tr>
<tr>
<td>Uninsured/Self-Pay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$15,000</td>
<td>100</td>
<td>14%</td>
<td>19</td>
<td>11%</td>
<td>22</td>
<td>14%</td>
</tr>
<tr>
<td>$15,001-$25,000</td>
<td>220</td>
<td>32%</td>
<td>54</td>
<td>33%</td>
<td>40</td>
<td>26%</td>
</tr>
<tr>
<td>$25,001-$40,000</td>
<td>240</td>
<td>34%</td>
<td>57</td>
<td>34%</td>
<td>60</td>
<td>39%</td>
</tr>
<tr>
<td>$40,001-$57,000</td>
<td>104</td>
<td>15%</td>
<td>28</td>
<td>17%</td>
<td>25</td>
<td>16%</td>
</tr>
<tr>
<td>≤ $75,000</td>
<td>16</td>
<td>2%</td>
<td>5</td>
<td>3%</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Unknown</td>
<td>17</td>
<td>2%</td>
<td>3</td>
<td>2%</td>
<td>5</td>
<td>3%</td>
</tr>
</tbody>
</table>

* Patients living within a radius greater than 216 miles were no longer in Massachusetts; therefore, it was hypothesized that the wrong address was on file for these patients and this field was left blank.
Figure 1. A) Frequency of 11 chronic illnesses in the population. B) Frequency of health status groupings.
Data for this analysis was obtained from RPDR.

*Figure 2.* ED utilization pre- and post-enrollment in CCC for each annual cohort.

*Figure 3.* CCC-IMA capacity utilization from 2011 to 2016. Capacity utilization is defined as actual CCC outpatient visits divided by potential CCC outpatient visits.

*Data on actual visits was taken from RedCap database. Data on potential visits was approximated based on the assumption that 10 patients can be seen per clinic night, and the clinic operates for 45 full-capacity weeks per year.
References


