Original Research

The Effect of Starting a New Residency Program on the Quality of Care Measures at a Community Hospital: A 2-Year Follow-Up

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Abstract

Background
Introducing graduate medical education to a non-teaching hospital has been a challenging issue due to its perceived possible negative impact on quality and cost of care.

Objective
To assess the impact of starting a new Internal Medicine (IM) residency program on the quality of care measures in a Graduate Medical Education (GME) naïve community hospital.

Methods
In a retrospective longitudinal study, we compared quality of care parameters (mortality rate, 30-day readmission rate, length of stay, case mix index and severity level) for a hospitalist group ten months before (September 2015–June 2016) and two consecutive years (July 2016–June 2018) after the implementation of an IM residency program at a community hospital.

Results
We compared the aggregated data from 1,295 patients before starting the residency program to 2,532 and 3,061 patients, in two consecutive academic years after initiating an IM residency. For the hospitalist group that became the teaching group, the mortality rate decreased significantly from 10 months pre- and the two post-residency periods (2%, 1% and 0.2%, p-value < 0.01), while the mortality rate among non-teaching hospitalist group patients at the same hospital remained unchanged over the same time period ($p = 0.70$). Length of stay decreased significantly from 10-months pre-residency to 1-year post-residency (6.23 and 5.31, p-value = 0.01). Furthermore, there were no other significant differences between the groups in terms of 30-day readmission rate, complications in care and average cost per case.

Conclusions
Starting a new residency program in a non-teaching hospital improves mortality rate without significantly affecting other quality measures.

Keywords
graduate medical education; hospital mortality; teaching hospitals; quality of care; mortality rate; 30-day readmission; length of stay

Introduction
There is a shortage of physicians across the country, and yet introducing graduate medical education to teaching–naïve hospitals is a challenging means to an end. Hospitals may fear an overall decline in quality, efficiency and care when adding resident physicians to their institution. Multiple studies demonstrated an overall improvement in the quality of care, including mortality rates. However, other studies have found no significant difference between teaching and non-teaching hospitals. All pre-

vious studies to date are at least 15 years old, and none of them have investigated the effect of starting a residency program at a graduate medical education (GME) naïve hospital.

A study by Brennan et al. reviewed 30,121 randomly selected records from 51 randomly selected acute-care, non-psychiatric hospitals in New York State in 1984. They concluded that more frequent adverse events occur in medical school affiliated teaching hospitals than non-teaching hospitals. However, these adverse events were less likely due to negligence.[1] Another study by Keeler et al. in 1992 demonstrated improved quality of care including a lower 30-day mortality rate in teaching hospitals compared to non-teaching hospitals. They looked at 14,008 Medicare patients with hip fracture, stroke, pneumonia, acute myocardial infarction or congestive heart failure in 297 hospitals from 5 states from 1981 to 1982 and 1985 to 1986.[2] Polanczyk et al. in 2002 looked at a New York State hospital database for more than 300,000 patients who were admitted for heart failure, myocardial infarction or stroke from 1993 to 1995 and compared in-hospital mortality ratios between teaching and non-teaching hospitals. Although there were differences between medical school affiliated and non-affiliated teaching hospitals, this study concluded that in-hospital mortality ratios were significantly lower in teaching hospitals than non-teaching hospitals.[3] Taylor et al., in another study from 1999, focused on cost and quality of care for more than 3,000 above 65-year-old Medicare patients admitted to teaching hospitals. They used Medicare claims and National Long-Term Care Survey data to assess hospitalizations for hip fracture, stroke, coronary disease or congestive heart failure between January 1984 and December 1994. They followed survival through 1995. They concluded that admission to medical school affiliated teaching hospitals was associated with greater costs to Medicare, but overall survival was better at teaching hospitals.[4]

Riverside Community Hospital (RCH) has participated in medical education through their affiliation with University of California, Riverside School of Medicine (UCR-SOM) for medical school rotations since 2014. However, RCH became a base for GME when it welcomed its first class of Internal Medicine (IM) residents in July 2016.

Our aim was to assess the impact of starting a new IM residency program in a non-teaching hospital on quality of care.

Methods

This study was exempt from IRB approval by HCA Healthcare according to institutional policy. We compared quality of care measures for both teaching and non-teaching hospitalist groups for ten months before (September 2015–June 2016) and two consecutive years after (July 2016–June 2018) starting a new residency program. One of the Inpatient Adult Medicine Hospitalist groups incorporated the new IM residents onto their service and became the GME Adult Medicine Service. The remaining groups did not work with the residents. The assignment of patients to teaching vs. non-teaching groups was based on their insurance type, and no patients were left unassigned. Both insured and noninsured patients who were not assigned to one of the non-teaching medical groups were subsequently assigned to the teaching group. The quality measures compared included yearly mortality rates, 30-day readmission rates and length of stay per case.

Our study considered the case mix index (CMI) and severity level of illness to adjust the average cost per patient for a given diagnosis related group (DRG). Case mix index addresses utilized resources between teaching and non-teaching groups after matching respective patient populations, while severity level of illness accounts for the severity of a given case for the same diagnosis,[5,6]

All admitted patients were dichotomized by their admission date into pre-residency and post-residency cohorts. The two cohorts were then compared based on the severity level, case mix index, length of stay, mortality rate, 30-day readmission rate and cost of care.

Excluded individuals included those under the age of eighteen and patients admitted to non-Medicine services (Surgery, OB-Gyn, etc.). Age brackets, gender and insurance type were compared using chi-square analysis. Case mix index, severity level, length of stay, 30-day readmission and mortality rate were compared using analysis of variance (ANOVA). Pairwise

comparisons were conducted using Scheffé Test.

CRIMSON care management platform by the Advisory Board Company was used for data extraction and IBM SPSS 25.0 was used for statistical analysis.

CRIMSON care management platform (https://www.advisory.com/) is a web-based software used to obtain aggregate quality and performance data and to compare them to other physician groups or hospital centers. The patient population included all patients 18 or older who were admitted to the medicine services at RCH.

Patients' demographic data were obtained from MediMobile billing software (https://www.medimobile.com/medical-billing/).

Results

The aggregated data from patients treated on the Hospitalist Service from June 2015 through June 2017 were included in this study. Over the three-year period there were no significant differences in terms of age, gender and insurance status. (**Table 1**)

Within the teaching group, CMI 2-year post-residency was significantly higher than that of 1-year post-residency (1.60 and 1.75, ANOVA p = 0.02) Length of stay decreased significantly from 10-months pre-residency to 1-year post-residency (6.23 and 5.31, p = 0.01). Severity level also increased significantly over time during the three periods (2.29, 2.38 and 2.56, p ≤ 0.01). Mortality rate decreased significantly from 10 months pre- and the two post-residency periods (0.02, 0.01 and 0.002, p < 0.01). 30-day readmission and complications rate remained comparable over time. (**Table 2**)

Similarly, within the non-teaching group, CMI increased significantly over time during the three periods (1.57, 1.67 and 1.78, p < 0.01). Severity level increased significantly over time during the three periods (2.41, 2.47 and 2.53, p < 0.01). 30-day readmission rate increased from 10-months pre-residency to 2-year post-residency (0.14, 0.12, p = 0.01). (**Table 2**)

Compared to the 10-month period prior to having a residency program, there was a statistical significance in the mortality reduction within the teaching service during the two post-residency years. However, there were no significant changes in mortality in the non- teaching services over the three years.

Discussion

Multiple studies have compared quality of care measures in teaching and non-teaching hospitals. However, none of these studies to our knowledge have compared these measures at the same hospital for the same group both before and after initiating a teaching service. Some of the previous studies did show im-

Table 1. Patients' demographic data

		September 2015– June 2016 (n=1,295) (Before residency)	July 2016– June 2017 (n=2,532) (First year after residency)	July 2017– June 2018 (n=3,061) (Second year after residency)	P value
Age	**≥65**	427 (33%)	836 (33%)	1,010 (33%)	0.99
	<65	868 (67%)	1,696 (67%)	2,051 (67%)	
Gender	**Male**	686 (53%)	1,342 (53%)	1,622 (53%)	0.99
	Female	609 (47%)	1,190 (47%)	1,439 (47%)	
Insurance Status	**Insured**	1,217 (94%)	2,329 (92%)	2,816 (92%)	0.05
	Uninsured	78 (6%)	203 (8%)	245 (8%)	

Table 2. Quality of Care Measurements over Three Periods

		September 2015–June 2016 (n=1,295) (Before residency)	July 2016–June 2017 (n=2,532) (First year after residency)	July 2017–June 2018 (n=3,061) (Second year after residency)	P value
Case Mix Index	Teaching service	1.61	1.60	1.75	0.02†
	Non-teaching service	1.57	1.67	1.78	<0.01*,†,‡
	P value	0.39	0.04	0.35	
Severity Index	Teaching service	2.29	2.38	2.56	<0.01*,†,‡
	Non-teaching service	2.41	2.47	2.53	<0.01*,†,‡
	P value	<0.01	<0.01	0.21	
Average Length of Stay	Teaching service	6.23	5.34	5.71	0.01*
	Non-teaching service	5.26	5.23	5.11	0.46
	P value	<0.01	0.49	0.01	
30-Day Re-admission Rate	Teaching service	0.10	0.09	0.10	0.45
	Non-teaching service	0.14	0.13	0.12	0.01‡
	P value	0.01	<0.01	0.05	
Mortality Rate	Teaching service	0.02	0.01	0.002	<0.01*,‡
	Non-teaching service	0.03	0.03	0.03	0.70
	P value	0.03	<0.01	<0.01	

* September 2015–June 2016 vs July 2016–June 2017.

† July 2016–June 2017 vs July 2017–June 2018.

‡ September 2015–June 2016 vs July 2017–June 2018.

P-values were calculated using two-mean independent sample t-test, ANOVA and Scheffé Test.

provement in mortality among the teaching hospitals, but at the expense of increased cost of care and average length of stay as displayed in the following studies.

Kupersmith et al. in a systemic review from 2005 analyzed 23 studies published from 1989 to 2004 that compared quality of care between teaching and non-teaching hospitals. This study concluded that favorable results were found in teaching hospitals, but not across the board to achieve statistical significance.[7] In another systematic review done by Ayanian et al. in 2002, 20 research articles published from 1985 to 2001 comparing quality of care between teaching and non-teaching hospitals were reviewed. They evaluated the appropriate use of drugs, outcome measures and preventable adverse effects as measures of quality. They divided their findings based on medical records and administrative data. They concluded that teaching hospitals generally provide better care than non-teaching hospitals, but endorsed a variation of quality based on condition.[8]

Our academic hospitalist group did not have control over the volume of patients, CMI and severity of illness of patients admitted to the teaching service.

There are several factors that may have positively affected the quality measures after starting the residency program, including improvement of communication, resource utiliza-

tion and group dynamics among residents and attending physicians.

During orientation week at the beginning of residency, IM residents receive extensive training on using the electronic medical record system, hospital workflow, major procedure techniques at the simulation lab, Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS) training and a comprehensive sign out system called I-PASS. The I-PASS (Illness severity, Patient summary, Action list, Situation awareness and contingency planning, Synthesis by receiver) is a package of interventions created to standardize communications during transition of care.[9] This was in contrast to the non-standardized handoff process that was being used by the hospitalists before having the residents on their teams.

Furthermore, residents actively participated in multiple hospital leadership committees such as quality and safety, blood utilization and antibiotic stewardship. This participation, along with general medical education requirements such as morbidity and mortality conferences, morning reports and academic daily conferences further prepared residents for providing a higher quality of patient care.
The residency program also implemented a quality improvement/high value care rotation that promotes high value-cost conscious care. This rotation helped residents to engage in hospital-wide quality improvement projects that subsequently reduced length of stay and lab utilization, without compromising quality of care.

Further improvements can also be attributed to constant feedback between faculty members and residents that resulted in better performance among physicians and higher quality of care.

In addition, by recognizing the faculty members who were more cognizant of resource utilization, the teaching service established a culture of cost effectiveness and high quality care among the physicians.

These joint efforts made by both faculty and residents contributed to an overall improvement in mortality rate in the same teaching group as compared prior to having residents.

Mortality rate in the teaching group was significantly lower after residents joined the group despite the increase in severity level, CMI and number of patients. Having residents on the teaching service decreased the length of stay for the first year after the residency. The teaching service also had a lower readmission rate, likely due to residents' efforts in assuring that patients receive the best care, pre-discharge instructions and a follow up appointment with the residents' clinic.

Of note, the increase in patient volume for this service noted over the years, which lead to the addition of 2 more teams, did not have a negative impact on the measured parameters.

There are several limitations to our study. This is a retrospective cohort study that is inherently subject to selection bias. The quality of care measures were available just for ten months before the start of the residency program (September 2015–June 2016) for the teaching service. Cases recruited were under the care of a single hospitalist group and may poorly represent disease in the general population. Our patient population included a significant number of uninsured and unassigned patients that did not seek prior medical attention. These patients presented with a high severity index and multiple co-morbidities. In addition, these same patients did not necessarily follow up outpatient as they were advised upon discharge, and subsequently returned to the emergency department shortly after discharge, contributing to the readmission rate.

Conclusion

Our study suggests that having a residency program in a community hospital is associated with improved quality of patient care. The study displayed that a teaching service significantly decreased the overall mortality rate. Some factors including a standardized transition of care system, GME residents' conferences and committees, and a constant feedback system among team members may have contributed to the decrease in adverse outcomes and mortality rate.

The marginal decrease in the mortality rate during the second year of the residency program can be attributed to the team approach of the attending physician, senior residents

and interns in providing patient care.

Our findings are encouraging to other hospitals and healthcare systems that are considering opening new IM residency programs in their facilities. The goal in moving forward is to focus on improving outcomes that matter to the patient while balancing the cost of care.

The preliminary findings of this study were reported at the Society of Hospital Medicine national meeting in 2019.[10]

Conflicts of Interest

The authors declare they have no conflicts of interest.

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