Use of a 90-Minute Admission Window and Front-Fill System to Reduce Work Compression on a General Medicine Inpatient Teaching Service

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ABSTRACT

Background Duty hour limits have shortened intern shifts without concurrent reductions in workload, creating work compression. Multiple admissions during shortened shifts can result in poor training experience and patient care.

Objective To relieve work compression, improve resident satisfaction, and improve duty hour compliance in an academic internal medicine program.

Methods In 2014, interns on general ward services were allotted 90 minutes per admission from 3 PM to 7 PM, when the rate of admissions was high. Additional admissions arriving during the protected period were directed to hospitalists. Resident teams received 2 patients admitted by the night float team to start the call day (*front-fill*).

Results Of the 51 residents surveyed before and after the implementation of the intervention, 39 (77%) completed both surveys. Respondents reporting an unmanageable workload fell from 14 to 1 ($P < .001$), and the number of residents reporting that they felt unable to admit patients in a timely manner decreased from 14 to 2 ($P < .001$). Reports of adequate time with patients increased from 16 to 36 ($P < .001$), and residents indicating that they had time to learn from patients increased from 19 to 35 ($P < .001$). Reports of leaving on time after call days rose from 12 to 33 ($P < .01$), and overall satisfaction increased from 26 to 35 ($P = .002$). Results were similar when residents were resurveyed 6 months after the intervention.

Conclusions Call day modifications improved resident perceptions of their workload and time for resident learning and patient care.

Introduction

In 2003, the Accreditation Council for Graduate Medical Education (ACGME) established the 80-hour work week for residents, and in 2011, it instituted additional regulations, which restricted shift length to 16 consecutive hours for interns.[1] These regulations shortened the shift length without a concurrent reduction in workload, thus creating work compression.[2] The consequence for resident education was less time to spend with and learn from patients.

We focused on the problem of work compression exacerbated by a clustering of admissions between 3 PM and 7 PM on call days in an internal medicine residency program. Our aim was to relieve work compression and improve the timeliness of patient care, time for resident learning, and resident satisfaction without reducing admissions to the teaching service.

Methods

Setting and Participants

We implemented a pilot intervention on the general inpatient teaching services at Barnes Jewish Hospital/Washington University, a 1252-bed hospital with an internal medicine training program of 159 residents.

The program has 2 general medicine services, each with 4 teams. Each team comprises 1 attending, 1 upper-level resident, and 2 interns. Teams admit patients (on call) every fourth day. While the ACGME allows up to 16 continuous hours for interns,[3] our intern call day is 14.5 hours (7 AM to 9:30 PM) to allow for 10 hours off before starting the postcall day. Each service also has a night float upper-level resident and intern who cross-cover the day team's patients.

Prior to the intervention, teams admitted new patients from 7 AM to 7 PM. Based on the ACGME internal medicine inpatient caps,[3] each team could admit up to 10 new patients, with up to 5 new patients per intern. Each night float team admitted 2 patients, who were handed off to the day teams on the third day of their call cycle; they also admitted patients for postcall teams who had not achieved patient caps on their call day.

Program Description

To relieve work compression from admissions clustering between 3 PM and 7 PM on call days, we implemented a 2-component intervention consisting

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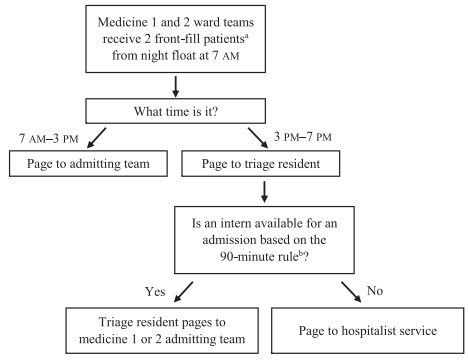

FIGURE
New Call Day Structure

[a] Front-fill were patients fully admitted by night float and presented to the call team. This strategy maximized the potential for each team to reach its patient cap and meant that each intern had 4 more patients to admit.

[b] Interns received 90 minutes to admit each patient between 3 PM and 7 PM. If all 4 admitting interns were unable to take their next patient because of the 90-minute rule, the patient was paged to a nonteaching hospitalist service.

BOX Resident Estimates for the 90-Minute Rule

Activity
- 45 minutes: Interview and examine the patient
- 15 minutes: Medicine reconciliation
- 10 minutes: Medical record review
- 10 minutes: Miscellaneous (eg, call consults, obtain outside records, call the primary care physician)
- 10 minutes: Dictate
- 10 minutes: Place orders

of a front-fill system and a 90-minute window for admissions (FIGURE). The 90-minute limit was derived from resident estimates of the tasks involved in an admission (BOX). Even if the last patient was assigned to the team at 7 PM, the 90-minute window allowed interns to complete call-day admissions by 8:30 PM, leaving an hour to review the patient list, sign out, and leave the hospital by 9:30 PM.

Program Evaluation

We trialed the new system between October 7, 2014, and January 18, 2015 (three 1-month-long blocks), and surveyed eligible residents on the general medicine services pre- and postintervention. Eligible residents were defined as upper-level residents and interns who had previously completed a general ward rotation. The survey was designed by faculty, including the authors; additional evidence of validity was not obtained. We used Qualtrics (Provo, Utah) to send surveys. Survey responses were rated on a 4-point Likert scale, then grouped in a binary fashion for analysis (strongly disagree and disagree versus strongly agree and agree). At the end of the trial period, we asked residents who had completed earlier surveys which aspects of the intervention they found helpful. Six months after the trial period ended, we resurveyed the same group. We compared preintervention survey responses to immediate postintervention and end-of-academic-year responses using the mid-P McNemar test for paired data. We performed subgroup analyses of upper-level residents and interns.

We reviewed hospital admissions data to track the number of admissions taken by call teams between July 1, 2014, and April 3, 2015, and used Fisher's exact test to compare the proportion of patients admitted pre- and postintervention.

The Washington University Human Research Protection Office provided an exemption from Institutional Review Board approval.

All statistical calculations were done using R version 3.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

Results

A total of 51 residents received surveys before and immediately after implementation of the new system, and 39 (77%) completed both surveys (TABLE 1). Marked, significant improvements were found in all areas surveyed, which persisted at 6 months. Results were similar in the subgroup analyses of interns and upper-level residents, although not all survey items achieved statistical significance in the subgroups.

More than two-thirds of residents felt that both the front-fill and the 90-minute rule were helpful and wanted to keep both components immediately postintervention (TABLE 2). At the conclusion of the trial period in January 2015, the intervention was permanently implemented.

We achieved these results without an overall reduction in the number of patients admitted by residents, either in total admissions or the proportion of days during which teams admitted a full complement of patients (TABLE 3). There were no reported patient safety events related to night float admissions.

Discussion

Call day modifications led to large, statistically significant improvements in residents' perception of time for learning and patient care, workload, and duty hours without reducing the number of admissions to the teaching service.

While prior interventions have been successful in relieving work compression, our approach required

TABLE 1
Resident Responses Regarding the General Inpatient Ward Experience: Pre- and Postintervention

Survey Question	Year	No. (%) of Residents Who Agree			*P* Value Between Preintervention and Postintervention Immediate	*P* Value Between Preintervention and Postintervention After 6 Months
		Preintervention (n = 39; 16 Interns, 23 Upper-Level Residents)	Postintervention Immediate (n = 39; 16 Interns, 23 Upper-Level Residents)	Postintervention After 6 Months (n = 36; 14 Interns, 22 Upper-Level Residents)		
On call days, my workload is manageable on the inpatient ward service.	Total	25 (64)	38 (97)	36 (100)	< .001	< .001
	Intern	10 (62)	15 (94)	14 (100)	.031	.031
	Resident[a]	15 (65)	23 (100)	22 (100)	.004	.008
On call days, I am able to see my patients in a timely manner once they are paged out.	Total	25 (64)	37 (95)	36 (100)	< .001	< .001
	Intern	11 (69)	15 (94)	14 (100)	.06	.06
	Resident	14(61)	22 (96)	22 (100)	.012	.004
I have adequate time to spend with my patients on the inpatient ward service.	Total	16 (41)	36 (92)	34 (94)	< .001	< .001
	Intern	6 (38)	15 (94)	14 (100)	.002	.002
	Resident	10 (43)	21 (91)	20 (91)	< .001	.002
I have time to learn from my patients on the inpatient ward service.	Total	19 (49)	35 (90)	32 (89)	< .001	< .001
	Intern	6 (38)	16 (100)	13 (93)	< .001	.004
	Resident	13 (57)	19 (83)	19 (86)	.039	.021
I leave on time on call days.	Total	12 (32)	33 (85)	33 (92)	< .001	< .001
	Intern	4 (27)	12 (75)	12 (86)	.021	.008
	Resident	8 (35)	21 (91)	21 (95)	< .001	< .001
I am satisfied with my inpatient ward experience.	Total	26 (67)	35 (90)	32 (89)	.002	.012
	Intern	11 (69)	16 (100)	12 (86)	.031	.038
	Resident	15 (65)	19 (83)	20 (91)	.06	.016

[a] This term represents an upper-level resident.

TABLE 2
Resident Responses Regarding Intervention Components

	No. (%) of Residents Who Agree			
	Postintervention Immediate (n = 37)		Postintervention After 6 Months (n = 36)	
	The Following Helped With the Call Day on the Inpatient Service:	I Would Like to Keep the Following Parts of Restructuring Call:	The Following Helped With the Call Day on the Inpatient Service:	I Would Like to Keep the Following Parts of Restructuring Call:
Front-fill alone	10 (27)	8 (22)	14 (39)	13 (36)
90-minute rule alone	0 (0)	1 (3)	1 (3)	2 (6)
Both components	26 (70)	27 (73)	21 (58)	21 (58)
Neither component	1 (3)	1 (3)	0 (0)	0 (0)

no additional funding. This intervention aimed to redistribute resident workload on call days, whereas previous studies decreased the number of patients per resident and required resource-intensive components.[4–6] Some programs have moved from a traditional *bolus* call system like ours (with teams taking new admissions on 1 day of the call cycle) to a *drip* system (with multiple teams taking fewer admissions daily), which has been shown to smooth daily discharge rates and statistically decrease length of stay.[7] However, the impact of a drip system on resident hours, workload, and education is unknown, and our approach may be a less dramatic and feasible way of smoothing call-related workflow. Trials of duty hour flexibility may move us toward fewer duty hour restrictions[8,9]; yet even with duty hour flexibility, clustering of admissions would continue, keeping the findings from our intervention relevant.

Limitations of this study include the lack of a control group. We also may have had results benefiting from the *July effect* of residents improving their efficiency through the academic year. However, a subgroup analysis of residents completing a ward rotation less than a month prior to the intervention (where we would expect less difference in experience) showed similar results to the overall group. Because our sample size was small, subgroup analyses were limited in their ability to achieve statistical significance (interns versus upper-level residents), and other analyses were not conducted (preliminary versus categorical interns). Our survey tool did not have validity evidence, and respondents could have interpreted questions differently from what was intended. We also did not directly measure time spent in patient care and educational activities, patient satisfaction, attending satisfaction, or night float resident satisfaction, potentially missing benefits and consequences in these areas. For example, some residents informally expressed less ownership or knowledge of front-fill patients, and formal assessment of patient care measures may have helped capture additional potential consequences.

Future considerations include modifying the 90-minute rule to 60 minutes later in the academic year, when interns become more efficient in their workflow, and adapting the modifications for other inpatient units.

Conclusion

Call day modifications (that included a front-fill with admitted patients and a 90-minute admission window) led to large, statistically significant improvements in residents' perception of time for learning and patient care, workload, and duty hours, without reducing the number of admissions to the teaching service.

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TABLE 3
Resident Admissions Preintervention and Postintervention

	Preintervention, No. (%)	Postintervention, No. (%)	*P* Value
Proportion of patient care days[a] with patient cap taken	134/146 (92)	327/360 (91)	.86
Proportion of possible admissions[b] taken	1633/1660 (98)	4060/4112 (99)	.32

[a] Defined as literal days × 2 to account for 2 general ward teams.
[b] Defined as both call teams taking 10 admissions and both teams on the third day of their call cycle receiving 2 patients from night float.

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