BRIEF
REPORTS

The Marshall Family Medicine Residency twINTERN Schedule:

The Impact of an Innovative Hospital Coverage Scheme on Resident Fatigue

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BACKGROUND AND OBJECTIVES: Work hour restriction has strained the balance between resident service and education. Night Float (NF) rotations are a popular answer to managing this balance but weakens continuity, an essential tenant of family medicine. An innovative short call system for Marshall University's Family Medicine Hospital Service (FMHS), the twINTERN call model, was created in response. We studied the impact of this approach on resident fatigue.

METHODS: Anonymous surveys assessed fatigue of the Marshall University's 2013–2014 Family Medicine intern resident class while on NF rotations (ICU, Pediatrics and Surgery) and the twINTERN call. Stanford Sleepiness Score (SSS) and Epworth Sleepiness Score (ESS) were administered trimonthly. Results were categorized 'Alert' or 'Fatigued' and evaluated by Chi Square analysis. Also, outpatient office frequency was evaluated.

RESULTS: 146 surveys were completed by eight residents. More even distribution of resident office experience was seen. The twINTERN call model didn't show worsening fatigue compared to NF systems in any parameter measured. It was superior mitigating fatigue by ESS for night shifts (*P* value 0.047). While fatigue was statistically worse for night float rotations by both parameters (ESS *P* value = 0.009; SSS *P* value = 0.008), the twINTERN call model only showed worsening fatigue in the SSS (*P* value = 0.038).

CONCLUSIONS: Our study demonstrated that the twINTERN Call Model, which allows for improved continuity on the inpatient service, was at least as effective, and by some parameters superior to NF systems for mitigating resident fatigue.

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In 1984, the Bell Commission's changes in work hour rules for graduate medical education attempted improved safety by mitigating fatigue mediated medical errors.[1,2] Beginning July 2003, 'Call' was restricted to 24 hours with a maximum of 30 consecutive hours in any capacity and a maximum of 80 work hours a week with one day off in seven. In July 2011, first year residents (PGY 1) could no longer work a full 24-hour shift and required direct supervision.[3]

As a result, residencies have altered inpatient rotation structures attempting to balance service and education priorities. Following the 2003 changes, 71% of coverage evolved into cross covering night float/day shift (NF/DS) systems,[4,5] requiring residents from other rotations, unfamiliar with the service's patients, to fill coverage gaps. Alternate options have included additional hiring practices[6] and augmented nursing requirements.[7]

Perceptions of hour restrictions were mostly negative with only 30% of family medicine (FM) residents in support, while 41% were unsatisfied or very unsatisfied.[8] Twenty percent of graduates believed duty hour changes restricted their clinical training,[9] diminishing FM's strong emphasis on continuity. Negative consequences of continuity disruptions have also been expressed in other specialties.[10,11]

Actual impact of duty hours has been uneven. Initial studies demonstrated that duty hours violations increased poor outcomes,[12] but later surveys showed less than expected improvements in resident health.[13] Surgical specialties noted increased errors, from increased transitions[14] and educational limits from lack of surgical cases.[15]

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The Marshall University Family Medicine Residency Program developed an inpatient call model to maximize continuity of care, enhance educational opportunities, and support continuity outpatient practices. A typical NF/DS system impacts negatively upon these goals. We labeled our approach the twINTERN call model (TCM).

The TCM is a self-contained short call system utilizing two third year (PGY 3) residents to supervise a four-day rotation of two PGY 1 and two second year (PGY 2) residents. The PGY 2 residents each take a standard 24-hour call. The remaining two consecutive days are split into 12-hour shifts, during which one intern covers the mornings on both days and the other the evenings. On the next four-day rotation, they switch call periods (Figure 1). Since fatigue is the rate limiting factor for educational time, we evaluated intern fatigue during the TCM, compared to NF/DS rotations to ensure its viability.

Methods

An anonymous survey (Figure 2) evaluated the fatigue of eight interns on the Family Medicine Hospital Service (FMHS), which employed the TCM, and rotations of ICU (supervised by intensivists), Pediatrics (supervised by pediatric faculty) and Surgery (supervised by surgical faculty), which utilized a typical 12-hour shift NF/DS system. The survey was administered at approximately the 3rd, 15th and 27th day of each tested month. The questionnaire included rotation details, work load questions and three fatigue ratings; the Epworth Sleepiness Score (ESS)[16], the Stanford Sleepiness Score (SSS)[17] and a qualitative 5-point Likert scale assessing the rotation's adverse effect. 0-10 on the ESS was 'alert', while 11 and above were 'fatigued'. The groupings were 0-3 and 4-7 respectively for the SSS. Differences were evaluated for statistical significance by the chi square method for Overall rotation fatigue, an external comparison between rotations' AM and PM results and an internal comparison within each rotation's AM vs. PM results. This protocol was approved by the Marshall University Institutional Review Board (ID# 809855-1).

Results

Eight residents (PGY1 class for academic year 2013-2014) were surveyed for a total of 146 surveys, demonstrating statistically similar response rates and work load compared to combined NF/DS rotations as outlined in Table 1, which also demonstrates outpatient clinical office frequency.

Table 2 provides an external comparison for Overall, AM and PM scores between the TCM and combined NF/DS rotations for ESS and SSS.

Table 3 provides an internal comparison of ESS and SSS of AM and PM scores within each rotation studied.

Discussion

Marshall's TCM provided coverage of clinical service obligations consistent with the newest duty hour requirements, while improving continuity of inpatient and outpatient clinical experiences (Table 1). Unlike many NF/DS systems, the TCM does not require coverage from residents unfamiliar with the inpatient service. For our TCM to be viable, residents could not experience excessive fatigue.

There were no statistical differences found between the overall scores of the TCM and the combined NF/DS systems (Table 2), demonstrating that, globally, the TCM is no more taxing despite comparable workload (Table 1). When the AM scores are analyzed, no scores showed any difference, demonstrating equal daily work strain. PM scores for the ESS showed increased tolerability of the TCM's nocturnal aspect (Table 2).

Differences between AM and PM shifts were seen within each rotation (Table 3), but only the SSS demonstrated a difference in the TCM. This is due to the incredibly good ratings for the TCM's AM category, which was the only measure found to be more 'alert' than 'fatigued'. Intrinsic differences were seen across both parameters in the combined NF/DS rotations, demonstrating greater disparity of fatigue between DS and NF.

Limitations of standardization were minimized by the same eight family medicine residents being surveyed longitudinally. Equal work within each rotation ensured a fair comparison of busy-ness (Table 1) despite being run by pediatric, surgical and intensivist specialties. One limitation, resident attitude, could not be controlled by design. Family medicine residents may look more favorably toward family medicine rotations, minimizing fatigue scores. To eliminate this bias, an extension comparing family medicine residents on family medicine services in both NF/DS systems and TCMs could be undertaken and extended to programs of various sizes and governances.

A typical NF/DS week is five work nights and two off days, which serves to disrupt natural diurnal rhythms for up to a month. The twINTERN's benefit is the discrete bursts of evening work, allowing it to perform as well in mitigating fatigue, and better on many evening parameters than comparable NF/DS rotations, while allowing the benefit of attending continuity office and educational experiences.

Conclusion

Our study describes Marshall's TCM, an innovative short call system that improves continuity of care in both inpatient and outpatient settings, while mitigating intern fatigue levels at least as well as more common NF/DS systems.

Figure 1. Individual twINTERN Weekly Schedules

Intern Schedule+

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7 am	Call	Floor	Floor		Post Call *	Post Call	
9 am	Call	Floor	Floor			Post Call **	
11 am	Call	Office 2 pm – 5 pm	Floor				
7 pm				Call	Call		

* On the first Post Call Day, the Intern must leave by 9 am to ensure 10 hours off between shifts.

** On the second Post Call Day, the Intern may stay until 11 am, using the full 16 hours allotted per shift.

Junior Resident (JR) Schedule

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7 am		Call	Post Call	Floor	Floor	Call	Post Call
9 am		Call	Post Call*	Floor	Floor	Call	Post Call*
11 am		Call		Office 2 pm – 5 pm	Floor	Call	
7 pm		Call				Call	

* On the Post Call Day, may stay until 11 am.

Senior Resident (SR) Schedule

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7 am	Call	Post Call*	Call	Post Call	Call	Post Call*	Call
9 am	Call		Call	Post Call**	Call		Call
11 am	Call		Call/Office		Call/Office		Call
7 pm	Call		Call (home)		Call		Call (home)

* On the Post Call Day with Intern, must leave by 9 am as is in house for call.

** On the Post Call Day with Junior, may stay until 11 am.

*** SRs continue to supervise the hospital service while working in their continuity office (two weekday afternoons for the first SR and three weekday afternoons for the second SR).

+Schedules require two interns, two junior residents, and two senior residents to cover all morning sessions with four residents, afternoon sessions with two residents, and night sessions with two residents. Schedules are offset by one day for each pair of same level residents.

Figure 2: Fatigue Sheet

Rotation _____ Avg # of patients admitted per call this month _____
Date _____ Avg # of patients contacted per call this month _____
Time of day _____
Rotation last month _____

Rotation's Adverse Effect of Life
Please Check ❒ None ❒ Little ❒ Moderate ❒ High ❒ Excessive

If on Night Float, how long have you been on it? _____
If on Day Shift, how long have you been on it? _____
If last on twINTERN AM, when was the last time? _____
If last on twINTERN PM, when was the last time? _____

Rate these Situations on a Scale from 0–3
0 = No chance of dozing 1 = Slight chance of dozing 2 = Moderate chance of dozing 3 = High chance of dozing

_____ Sitting and readingV
_____ Watching TV
_____ Sitting Inactive in a Public Place
_____ Sitting for 1 Hour as a Passenger in a Car
_____ Lying Down in Afternoon to Rest
_____ Sitting and Talking to Another Person
_____ Sitting Quietly After a Lunch (No EtOH)
_____ Sitting in a Car for a Few Min d/t Traffic

Please Check Best Assessment of Your Current Level of Fatigue
❒ Feeling active, vital, alert, wide awake
❒ Functioning at a high level, not at peak, able to concentrate
❒ Relaxed, not at full alertness, responsive
❒ A little bit foggy, not at peak, let down
❒ Fogginess, losing interest in remaining awake, slowed
❒ Sleepiness, prefer to be lying down, fighting sleep, woozy
❒ Almost in reverie, sleep onset soon, losing struggle to remain awake

Table 1: Standardization and Continuity Data

Average office days/week

	Surveys(n)	Collection rate	Admits/Shift	Contacts/shift	On DS week	On NF week
FMHS*	71	98.6%	4.5	10.7	0.79	0.79**
Surgery	24	100.0%	5.9	22.8	0.83	0
ICU	24	100.0%	3.0	8.9	0.79	0
Pediatrics	27	96.3%	3.5	10.7	.77	0
Night Float	75	98.7%	4.1	14.0	.79	0

* FMHS = Family Medicine Hospital Service

** Since DS and NF on any given week are present, there was no difference seen.

Table 2: Comparison Between twIINTERN and Night Float Data

	EPWORTH*			STANFORD**		
	Alert	**Fatigued**	***P*-value**	**Alert**	**Fatigued**	***P*-value**
FMHS (overall)	23	48		29	42	
Night Float/ Day Shift	18	56	0.218	21	53	0.114
FMHS (AM)	13	23		19	17	
Day Shift	15	27	0.971	17	25	0.277
FMHS (PM)	10	25		10	25	
Night Float (combined)	3	29	0.047	4	28	0.106

FMHS = Family Medicine Hospital Service

* Alert is ≤ 10; fatigued is ≥ 11

** Alert is ≤ 3; fatigued is ≥ 4

Table 3: Comparison of AM to PM Data for twINTERN and Night Float Rotations

	EPWORTH*			STANFORD**		
	Alert	**Fatigued**	***P*-value**	**Alert**	**Fatigued**	***P*-value**
FMHS (AM)	13	23		19	17	
FMHS (PM)	10	25	0.497	10	25	0.038
Day Shift	15	27		17	25	
Night Float	3	29	0.009	4	28	0.008

FHMS = Family Medicine Hospital Service

* Alert is ≤ 10; fatigued is ≥ 11

** Alert is ≤ 3; fatigued is ≥ 4

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