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A Prospective Trial of an In-house Overnight Fellow Rotation in the Intensive Care Unit

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ABSTRACT

Background: Although previous studies in academic intensive care units (ICUs) have found no improvement in patient care outcomes with in-house overnight attending physician coverage compared with home call coverage, the effect of in-house supervision on trainee education and well-being is less clear. In addition, no studies have examined the effect of in-house coverage by fellow physicians overnight.

Objective: What is the impact of an in-house overnight critical care fellow on resident, fellow, and attending perception of patient safety, house staff education, and house staff well-being?

Methods: A prospective trial alternating 2-week periods of in-house overnight critical care fellow coverage with 2-week periods of home call coverage was performed in our tertiary medical ICU. Residents, fellows, and attendings were surveyed to evaluate perceptions of the night fellows' impact on patient care, communication, supervision, educational experience, autonomy, well-being, and job satisfaction.

Results: Over the 6-month study period, surveys were sent to 83 residents, 22 fellows, and 23 attendings, with completion by 56 (67%), 22 (100%), and 16 (70%), respectively. Overall, 89% of residents, 68% of fellows, and 81% of attendings reported perceived improvements in patient care with an in-house fellow. The in-house fellow was also associated with improved well-being in 79% of residents and 73% of fellows, and 82% of residents felt that it positively impacted education.

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Conclusion: As compared with the traditional home call system, an in-house night critical care fellow can improve the perception of patient care, trainee well-being, and education in a tertiary ICU at an academic hospital.

Keywords:

medical education; intensive care units; patient safety; personnel staffing and scheduling; burnout

The Accreditation Council for Graduate Medical Education has increasingly focused attention on mitigating house staff fatigue, improving patient safety and quality of care, and enhancing trainee education (1). The intensive care unit (ICU) is a particular source of interest because of its high patient acuity and time-intensive patient care requirements. Studies have previously demonstrated the patient-centered benefits of high patient acuity ICU care delivered by subspecialty trained intensivists compared with noncritical care trained physicians (2–5). However, whereas 24-hour intensivist coverage of a community hospital ICU has some demonstrated benefits (5), the utility of an in-house around-the-clock intensivist in an academic teaching hospital is less clear.

Prior work examined the difference between overnight in-person versus on-call attending intensivist supervision of resident trainees in the ICU at academic medical centers. Several studies have found no association between nighttime intensivist staffing and mortality of patients in the ICU (6–9). Many academic medical centers thus continue to rely on out-

of-hospital night supervision of medical resident trainees in the ICU, given that 24-hour in-house intensivist coverage requires significant human and financial resources (10).

Alternatively, the presence of in-house critical care fellows, trainees who have completed their residency and are seeking additional training in critical care medicine, provides an opportunity for increased oversight of resident-level trainees. This model of direct supervision has several potential benefits beyond patient safety outcomes. First, this may offer residents increased learning opportunities as well as enhanced emotional support in a high-stakes training environment. In addition, this affords a unique educational opportunity for fellows, as they can operate with more autonomy by making independent management decisions without the immediate direction of an attending. Lastly, from an operational perspective, the model provides additional supervision without the same financial burden as an in-house attending. Despite these potential benefits, however, no published studies to date have examined the impact of in-house overnight calls by critical care fellow physicians.

Author Contributions: K.S.J. and A.E.S. had full access to all of the study data and take responsibility for the manuscript, including the data and analysis. K.S.J., A.E.S., T.W., and K.M. contributed substantially to the study design, writing of the manuscript, and revision of the manuscript.

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We aimed to prospectively evaluate the effect of an in-house night fellow rotation on trainee satisfaction, education, autonomy, and perception of patient safety. We hypothesized that the presence of an in-house overnight critical care fellow would be associated with an improvement in the perception of patient safety and an increase in resident and fellow well-being, though at the cost of reduced resident autonomy.

METHODS

Study Design

We implemented an alternating in-house versus home call night staffing model from September 2019 through March 2020 at the Ronald Reagan University of California, Los Angeles (UCLA) Medical Intensive Care Unit (MICU), an academic tertiary 24-bed high acuity MICU. Before the study, all ICU coverage was performed via home call, with a fellow immediately available to residents via pager or cell phone, and with the expectation that the fellow (with or without the supervising attending physician) would come into the hospital at any point overnight for urgent patient care issues.

During the study period, 2-week blocks of in-house night fellow coverage (“night fellow” intervention weeks) alternated with 2-week blocks of the default home call coverage (“home fellow” control weeks) (Table E1 in the data supplement). The schedules of residents and fellows were staggered, such that residents would often experience both night fellow and home fellow call days over the course of their 2-week MICU rotations. For intervention weeks, the night fellow worked an in-hospital 12-hour shift from 7 P.M. to 7 A.M., with responsibilities including participating in evening rounds with the residents and nurses, staffing new admissions with the residents, assisting in MICU

procedures, and attending all code blue events. In addition to providing overnight coverage for the MICU, the night fellow also covered urgent consultations for the pulmonary consult, lung transplantation, pulmonary hypertension, and liver transplantation services. As such, during the intervention weeks, all daytime fellow rotations required daytime shifts only without any overnight call obligations.

During the control weeks, overnight coverage for all MICU and consultation services was performed by a home call fellow from approximately 7 P.M. to 7 A.M., according to the default guidelines. Consequently, the MICU residents performed all expected ICU responsibilities, including evening rounds, without direct supervision unless additional assistance was requested, in which case the MICU fellow was reachable by pager or telephone and able to return to the MICU on an as-needed basis.

This study was developed as a quality improvement initiative and was granted an exemption by the UCLA Institutional Review Board. It adhered to the Standard of Quality Improvement Reporting Excellence guidelines.

Data Collection

To assess perceptions of the night fellow rotation, surveys (Figures E1–E3) were sent to residents, fellows, and attending physicians at predefined points in time throughout the study period. Residents were surveyed at the conclusion of their 2-week MICU rotation. Fellows and attending physicians were surveyed every 3 months over the 6-month study period. If a fellow or attending completed both the 3- and 6-month survey, data from the 6-month survey was collected. If a resident had more than one rotation through the

MICU during the study time, the most recent completed survey was used for analysis. This allowed for the most longitudinal assessment of the intervention and yet did not exclude those who only participated early in the study.

To design the survey, the authors first performed a literature review to assess for existing and potentially relevant surveys. Meetings with relevant stakeholders from both the residency and fellowship program leadership were also held to solicit feedback regarding the survey design. The surveys were then evaluated by an external reviewer through the American Thoracic Society's Section of Medical Education research design consult service to further enhance survey validity, and changes were made accordingly. Finally, the surveys were piloted on 3–5 representative individuals from each surveyed group (i.e., residents, fellows, and attending physicians) to ensure that the survey questions were clear and took less than 5 minutes to complete in total.

Survey questions addressed perceptions of the night fellow's impact on patient care, communication, supervision, educational experience, autonomy, wellbeing, and job satisfaction. To assess the effects on burnout, we also included a one-item burnout question that has been validated and studied previously among practicing physicians (11–16). Surveys were distributed by MedHub, the healthcare graduate medical education management electronic system. Survey responses were collected anonymously, and participation in the survey was voluntary.

Statistical Methods

Descriptive statistics were used to characterize the study population, reporting continuous variables as means

with standard deviations and categorical variables as counts with frequencies. The chi-squared test was used to assess differences between categorical variables. All tests were two-sided, with significance set at $P \leq 0.05$. Statistical analyses were performed using STATA 16.0 software (StataCorp LLC).

RESULTS

The study occurred over 6 months from September 2019 until March 2020, when it had to be terminated early secondary to a surge in patient volume and acuity because of the novel coronavirus disease (COVID-19) pandemic, which necessitated continuous in-house fellow and/or attending MICU coverage. During the 6-month study period, 83 overnight residents and 23 attending physicians worked in the MICU. Twenty-two of the 25 UCLA pulmonary and/or critical care fellows rotated through the MICU during this period, and of these, 17 fellows provided at least 1 night and up to 13 nights of in-house coverage. Of the 83 resident surveys sent, 56 (67%) unique residents completed the survey. Four residents rotated through the ICU twice during the study period, yielding a total resident survey response rate of 72% (60 of 83 surveys). All 22 fellows (100%) responded to at least one survey for a total survey response rate of 95% (42 of 44 surveys). Seventy percent (16 of 23) of attendings responded to at least one survey, resulting in a 70% (21 of 30 surveys) survey response rate.

Baseline demographic data of the residents, fellows, and attendings are listed in Table 1. Notably, 32 (57%) residents indicated a future interest in procedural subspecialties such as pulmonary/critical care, cardiology, and gastroenterology, with 9 (16%) indicating an interest in

Table 1. Baseline demographics

	Residents (n = 56)
Age, yr (mean ± SD)	29 ± 1.8
Gender n (%)	
Female	21 (38)
Male	34 (61)
Choose not to answer	1 (2)
Year of training, n (%)	
PGY-1	23 (42)
PGY-2	24 (43)
PGY-3	9 (16)
Career interest,* n (%)	
Pulmonary/critical care	9 (16)
Cardiology	14 (25)
Gastroenterology	12 (21)
General internal medicine	11 (20)
Other or undecided	25 (44)
Baseline burnout score, n (%)	
Not burned out	36 (64)
Burned out	19 (34)
Prefer not to answer	1 (2)
Prior ICU calls, mean ± SD	
PGY-1	0
PGY-2	3 ± 3
PGY-3	8 ± 4
	Fellows (n = 22)
Age, yr (mean ± SD)	32 ± 1.5
Gender, n (%)	
Female	4 (18)
Male	18 (82)

Table 1. Continued.

	Fellows (n = 22)
Baseline burnout score, n (%)	
Not burned out	16 (73)
Burned out	6 (27)
	Attendings (n = 16)
Age, yr (mean ± SD)	40 ± 4.8
Gender, n (%)	
Female	8 (50)
Male	8 (50)
Baseline burnout score, n (%)	
Not burned out	11 (69)
Burned out	3 (19)
Prefer not to answer	2 (13)

Definition of abbreviations: ICU = intensive care unit; PGY = postgraduate year; SD = standard deviation.

*Some respondents chose multiple interests, resulting in the percentage not adding to 100%.

pulmonary/critical care specifically. Before the study, postgraduate year (PGY)-1, PGY-2, and PGY-3 residents had taken a mean of 0, 3 ± 3, and 8 ± 4 ICU calls with the default home call system.

On the basis of survey responses to the one-item burnout question, 19 (34%) residents and 6 (27%) fellows met the criteria for burnout at baseline, compared with 3 (19%) attendings. As residents and attendings did not always have longitudinal experience in the ICU over the study period, change over time was not calculated for the resident and attending groups. The number of fellows meeting the criteria for burnout increased over the course of the intervention from 6

(27%) at the 3-month survey to 9 (45%) at the 6-month survey.

Residents averaged 1.9 (± 1.8 ; range, 0–5) calls with an in-house fellow and 2.0 (± 1.9 ; range, 0–7) calls with a home fellow during the study. Overall, 44 (79%) residents reported that the addition of an in-house fellow improved well-being, whereas 7 (13%) felt that it made no impact, and only 1 (2%) felt that it negatively impacted well-being (Table 2 and Figure 1). The in-house fellow also improved job satisfaction in 43 (77%) residents. The majority of fellows also reported an improvement in their own well-being and job satisfaction, with 16 (73%) fellows reporting that the presence of an in-house fellow improved well-being and 2 (9%) reporting that it had a negative impact on well-being. Twelve (55%) fellows felt that it improved job satisfaction and 5 (23%) felt that it had no impact on their job satisfaction.

Residents also indicated that an in-house fellow improved education, with 46 (82%) reporting that it positively impacted, 4 (7%) reporting that it had no impact, and 2 (4%) reporting that it negatively impacted education. Fifty-one (91%) residents also found that supervision was improved with an in-house fellow. When asked about autonomy, only 11 (20%) felt that it negatively impacted autonomy. Fellows also reported improvement in their own education, with 9 (41%) reporting a positive impact, 7 (32%) reporting no impact, and none reporting a negative impact on their education.

Results from resident, fellow, and attending surveys also showed an improvement in perceived patient care with the presence of a night fellow. Fifty (89%) residents felt that it improved patient safety, 48 (86%) felt that it improved the quality of care of patients newly admitted, and 48 (86%) felt that it improved the quality of care of patients

previously admitted. Fifty (89%) residents perceived that it helped advance patient care overnight. Similarly, 15 (68%) fellows and 13 (81%) attendings believed that it improved patient safety. Overall, 47 (84%) residents, 18 (82%) fellows, and 13 (81%) of attendings preferred in-house fellow call to home call.

There were no significant differences in resident survey responses for any of the questions (well-being, job satisfaction, education, autonomy, patient safety, resident supervision, care of new patients, and care of old patients) when stratified by PGY level (Table E2). House staff reporting an interest in procedurally oriented subspecialties were more likely to report a positive or very positive impact on job satisfaction (88% vs. 63%; $P=0.037$) from the presence of an in-house night fellow (Table E3).

DISCUSSION

We found that the addition of an in-house night fellow improved trainee experience and perception of patient care in our tertiary MICU at an academic teaching hospital. Although we had hypothesized that this might come at the cost of reduced resident autonomy and thereby negatively impact the perception of resident education, we instead found that residents felt that this improved education and largely did not impact autonomy negatively.

Interventions to improve well-being have become increasingly prioritized in graduate medical education amid heightened recognition and scrutiny of trainee burnout. We found a higher rate of burnout in residents and fellows than attendings, with over one-third of residents meeting the criteria for burnout. Although our study was not primarily focused on evaluating burnout rates and used only a single-item question to assess burnout, this result mirrors reports from the literature, with

Table 2. Impact of a night fellow on residents, fellows, and attendings

	Positive/ Very Positive, <i>n</i> (%)	No Impact, <i>n</i> (%)	Negative/ Very Negative, <i>n</i> (%)	Unable to Assess, <i>n</i> (%)
Residents				
Well-being	44 (79)	7 (13)	1 (2)	4 (7)
Job satisfaction	43 (77)	8 (14)	1 (2)	4 (7)
Education	46 (82)	4 (7)	2 (4)	4 (7)
Autonomy	21 (38)	20 (36)	11 (20)	4 (7)
Patient safety	50 (89)	2 (4)	1 (2)	3 (5)
Resident supervision	51 (91)	1 (2)	1 (2)	3 (5)
Care of new admissions	48 (86)	3 (5)	2 (4)	3 (5)
Care of old patients	48 (86)	4 (7)	1 (2)	3 (5)
Fellows				
Well-being	16 (73)	0 (0)	2 (9)	4 (18)
Job satisfaction	12 (55)	5 (23)	1 (5)	4 (18)
Education	9 (41)	7 (32)	0 (0)	6 (27)
Patient safety	15 (68)	0 (0)	0 (0)	7 (32)
Resident supervision	16 (73)	0 (0)	0 (0)	6 (27)
Care of new admissions	15 (68)	2 (9)	0 (0)	5 (23)
Care of old patients	14 (64)	2 (9)	0 (0)	6 (27)
Attendings				
Well-being	8 (50)	5 (31)	0 (0)	3 (19)
Job satisfaction	6 (38)	7 (44)	0 (0)	3 (19)
Patient safety	13 (81)	0 (0)	0 (0)	3 (19)
Resident supervision	12 (75)	0 (0)	0 (0)	4 (25)
Care of new admissions	11 (69)	2 (13)	0 (0)	3 (19)
Care of old patients	11 (69)	2 (13)	0 (0)	3 (19)

disproportionately high rates of burnout, depression, and suicide described among medical trainees compared with the general population (17). Amid this work climate, the fact that an in-house fellow led to improvements in resident well-being and job satisfaction in over three-quarters of residents is particularly encouraging. In

addition, this did not seem to come at a significant cost to fellows, with only 9% of fellows reporting a negative impact on well-being. Although not analyzed in a methodical way, we estimate that fellows taking home call would typically field several phone calls overnight and have to return to the hospital an estimated one or

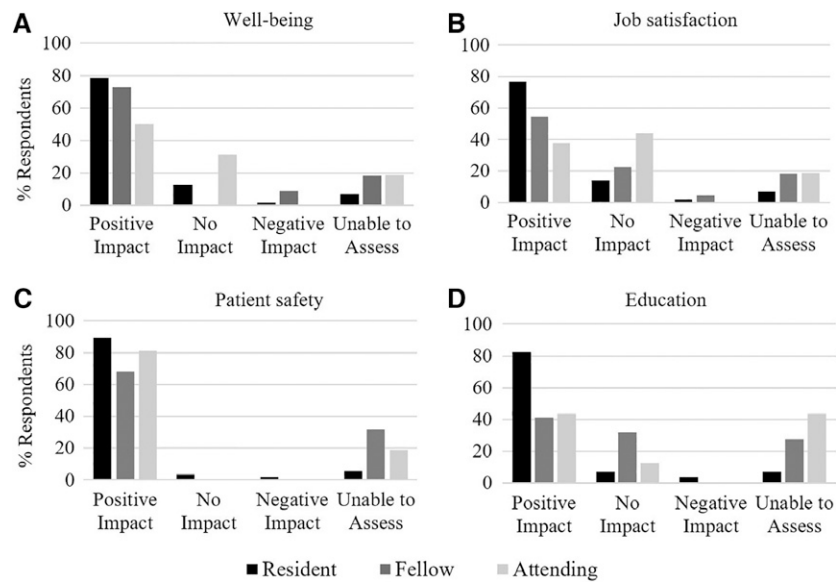


Figure 1. Impact of an in-house night fellow on (A) well-being, (B) job satisfaction, (C) patient safety, and (D) education.

two times per week on average. We suspect that the implementation of the night fellow rotation improved well-being among most fellows by removing any home overnight call burden for the daytime fellows in the ICU and pulmonary/critical care consultative services. The benefit of daytime shiftwork appeared to outweigh the burden of an infrequent dedicated in-house night rotation.

Although we did incidentally note an increase in fellow burnout over the course of the study, our study was not designed to identify causation and likely had multiple confounding external factors, including seasonality and variation in ICU workload, which may have contributed to the increase in fellow burnout over time (18–20). The effects of the COVID-19 pandemic may have additionally impacted burnout, as the latter assessment of burnout in fellows was obtained at the start of the COVID-19 pandemic in March 2020 (21–25).

From an educational standpoint, over 80% of residents perceived that the night fellow had a positive impact on their learning. This is similar to prior studies suggesting

that in-house attending staffing improves resident perceptions of nighttime education, with the added benefit that in-house fellows may be more approachable and less intimidating than their attending counterparts (8, 26). Night shifts offer unique challenges and possibilities for learning, with the negative impact of sleep deprivation and high patient censuses countered by increased opportunities for direct observation, procedural supervision, and bedside teaching (27). The fact that the large majority of residents did not believe that this came at the unwanted loss of autonomy is additionally notable and echoes prior study results with in-house attendings (28–30).

In addition to these benefits for trainees, the majority of survey participants perceived that an in-house fellow improved patient care. Although data from prior studies did not find improved patient mortality with in-house attending staffing (6–9), our findings suggest that there may be patient-centered metrics other than mortality that could be positively impacted by the presence of added resident supervision. Indeed, mortality may not represent the optimal

surrogate for patient care, particularly in ICUs with high amounts of aggressive end-of-life care. Despite a lack of mortality difference, the presence of in-house cardiology fellows has been found to improve door-to-balloon time in patients presenting with acute coronary syndrome (31). Future studies should directly investigate the impact of an in-house fellow on mortality and alternative patient-centered outcomes such as length of stay, cost of stay, procedure complication rates, and quality metrics, including compliance with sepsis core outcome measures and daily sedation holidays.

Limitations

Limitations include the single-center nature of the study, which may affect generalizability. It is possible, for example, that an in-house fellow would be perceived as less beneficial in smaller or lower acuity ICUs. Second, our study used a novel unvalidated survey, although we enlisted an external consultant to review it, piloted it on sample participants before launch, and incorporated a validated question on burnout into the survey. Finally, we acknowledge that our study assessed perceptions of education and patient care rather than direct knowledge-based or patient-centered outcomes, respectively. Our study is an initial single-center study designed to be proof of concept and hypothesis-generating, and future larger studies would ideally investigate higher quality outcomes. The strengths of our study include its prospective design and high participant response rate compared with other graduate medical education survey studies (32).

Lastly, the effects of the COVID-19 pandemic should be considered. The premature closure of our study because of the pandemic led to fewer survey participants and fewer opportunities than originally planned to compare resident overnight calls with

versus without an in-house fellow. Because of a surge in volume and acuity of ICU patients, our staffing model abruptly changed in April 2020 to include an in-house critical care attending or fellow overnight continuously. As such, we terminated the study in March 2020, limiting our intervention and data collection to 6 rather than 9 months. In addition, because the COVID-19 pandemic has added unprecedented stress on critical care staffing as well as a significant increase in burnout among both trainees and senior providers (21, 22, 25), our data may not fully represent the current wellbeing, burnout, and staffing needs in tertiary MICUs. This may be particularly relevant to critical care fellows, who have been disproportionately impacted by the COVID-19 pandemic and report higher degrees of anxiety, burnout, and stress compared with other trainees (24, 25). As such, it is possible that this nighttime staffing model, if evaluated now, would lead to different results.

Conclusions

In summary, this prospective trial in a tertiary academic ICU found that residents, fellows, and attendings preferred an in-house night fellow staffing model to a home staffing model. This model improved perceptions of patient care, resident education, and resident well-being and has the added benefit of being more cost-effective than in-house attending staffing. This was an initial hypothesis-generating study, and future studies are needed to further confirm these findings and their implications, particularly after the impact of the COVID-19 pandemic. Importantly, any benefits should be weighed in the context of the potential needs of the fellow trainees, especially regarding preserving their educational rotations and objectives as well as their well-being and sleep schedules during night-based rotations.

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