

Research Article

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Developing Survey Methodology to Assess Critical Care Medicine Staffing Patterns: A Feasibility Study



Teegarden BMT^{1*}, Hernandez A², Whitten CW³, Tripathi RS⁴, Williams GW⁵, Galusca DM⁶, Abouleish AE¹

¹Department of Anesthesiology, University of Texas Medical Branch, Galveston, USA

²Department of Anesthesiology, Vanderbilt University Medical Center, Nashville, USA

³Department of Anesthesiology and Pain Management, UT Southwestern, Dallas, USA

⁴Department of Anesthesiology, The Ohio State University, Columbus, OH, USA

⁵Department of Anesthesiology, UT Health McGovern Medical School at Houston, Houston, TX, USA

⁶Department of Anesthesiology, Michigan State University, Detroit, MI, USA

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***Corresponding author:** Teegarden BMT, University of Texas Medical Branch, Galveston, Texas, USA

Abstract

Objective: The primary goal of this study was to determine if our novel data collection form would result in comparative data of “days off” after specific critical care medicine (CCM) physician work shifts.

Design: The data collection form, structured on an hourly basis, distinguished between in-house and home calls, and did not ask for categorizing of shifts. We created shift categories based on grouping of hours worked and call coverage. Limited ICU demographics included total number of ICU beds, and if the CCM physician worked alone or with residents, fellows and/or advanced practice providers (APP). Days off post CCM work shift are reported overall and by shift category as average, median, standard deviation, and 25th, and 75th percentiles.

Setting: Known associates from 33 academic anesthesiology departments.

Measurements & Main Results: Thirty-three anesthesiology departments received the data collection form, with a response rate of 58%. Two departments (6%) could not complete the survey due to a fixed shift structure. The median time to complete the form was 5 min. Overall, ten CCM physician shift types were identified, defined by their various combination of weekday and weekend work. Of the 69 individual work shifts reported, 65 included a CCM physician working with residents, fellows and/or APP, and 4 CCM physician only shifts. The three most prevalent shifts were: 7 days in house with nighttime home call (n=18), 7 days in house without nighttime work (n=17), 7 nights in house without daytime work (n=10). For shifts involving 7 days of coverage (any combination of day or night), the average days off ranged from 2.5-3.6 (median of 3 days).

Conclusions: We believe this feasibility study demonstrates that our data collection form resulted in easily collected data from a variety of CCM staffing models, allowed for grouping of shifts, and aided in comparisons of time off per similar CCM work shift.

Key Points Summary

Question: Does our novel data collection form result in meaningful data to categorize CCM physician work shifts and compare days off after specific shifts?

Findings: Through this feasibility study, we noted that use of the data collection form was quick, allowed for identification of work shift categories, and reported days off for each shift type.

Meaning: Expansion to a nationwide survey would allow for broader assessments of current staffing trends, which may be valuable in adjusting compensation to compete with the market of critical care staff, allow for appropriate time off, and may aid in mitigating burnout.

Keywords: Anesthesiology; Feasibility Studies; Intensive Care Units; Workforce; Burnout

Abbreviations: ICU: Intensive Care Unit; APP: Advanced Practice Provider; NP: Nurse Practitioners; PA: Physician Assistant; CCM: Critical Care Medicine; FTE: Full Time Equivalent; SCCM: Society of Critical Care Medicine

Introduction

There is considerable variation amongst intensive care unit (ICU) staffing models, and a paucity of knowledge specifically on anesthesia critical care staffing [1]. When developing an ICU staffing model, one must consider multiple factors, such as the patient population, acuity, census, availability of non-physician advanced practice providers (APP) (Nurse Practitioners (NP) or Physician Assistants (PA)), the number of residents or fellow physicians, and the number of critical care medicine (CCM) physicians [2]. In addition, the work shifts including time off for the CCM physicians must be determined [3]. Further, compensation, either monetary or days off, may be given for the extra hours worked in the previous week. Due to these variables, it is not surprising that there is tremendous heterogeneity in staffing models and CCM physician work schedules. This heterogeneity makes surveying, categorizing, and comparing work shifts challenging.

Unlike operating room staffing, CCM physician shifts often involve evenings, nights, or weekends for several consecutive days. Increased workload coupled with patient acuity, bed shortages and staffing challenges, increase the days off needed for recovery and prevention of burnout though comes at a cost as “time is money” [4]. This “time” is a cost opportunity that not only allows for recovery from a work shift, but also time to develop professionally through academic pursuits, complete administrative responsibilities for an institution, or seek personal bliss. As a result of limited national surveys on staffing, CCM academic divisions and private groups struggle with defining a Full Time Equivalent (FTE) for a CCM physician and justifying their staffing model and days off when negotiating budgets with hospital or medical school administrators.

This feasibility study focused on determining if our novel data collection form would result in meaningful data collection to allow for staffing model comparisons and assessment of days off after a CCM physician work shift. As a result, leadership will be able to staff critical care services with sufficient resources that promote both patient care and physician wellbeing.

Methods

After meeting criteria for exemption from review by the University of Texas Medical Branch’s Institutional Review Board on September 14, 2022, for “Developing survey tool for benchmarking days off after working in critical care units” (IRB #22 0225), survey invitations were sent by email to professional colleagues in United States academic anesthesiology departments identified by investigators for this feasibility study without regard to geographic location. Procedures followed were in accordance with the ethical standards of the responsible committee and with the Helsinki Declaration of 1975, though no human or animal subjects were involved with this work. Final survey questions were developed through feedback and data from a pilot of six ICUs involving three states from the sites of the co-authors. Thirty-

three contacts in academic anesthesiology departments were identified. Surveys were distributed on September 15, 2022, with one reminder before closing the survey on November 18, 2022.

A data collection form was completed for each ICU covered by the department. This two-page survey included two parts and an illustrative example to aid in understanding how to complete this novel data collection form. The first part included instructions and three “demographic” questions about the ICU including the name of the ICU, the number of total beds available, and if residents, fellows, and/or APPs were present, or if the CCM physician worked alone (Figure 1a). In addition, the time to complete the survey for each ICU was collected. On the second part, respondents completed the data collection form based on a typical week of ICU coverage (Figure 1b). For each CCM physician, an hourly table for weekdays and weekends was completed and the number of days off the week after ICU coverage was documented. Respondents were asked if additional monetary compensation above their base pay was provided for working the shift (yes/no response).

Given the survey population of anesthesiologist CCM physicians, another way to think of this question was to compare if they instead worked in the operating room for those shifts would their pay decrease (YES) or remain the same (NO). Respondents indicated if the CCM physician worked specific hours, if the physician could leave the facility (i.e., home call), and if the physician worked alone for the hours (physician only). The form did not ask respondents to categorize the work shifts. Since the data collection form was structured on an hourly basis, and ascertained if it was in house or on home call, the data allowed for identification of work shifts. Examples of possible shifts included weekday in house without weekday night or weekend duties, weekday in house without weekday night but with weekend home duties both day and night, or only working in house weekday nights. Final shifts were determined by responses. In reporting data by all work shifts and then specific work shifts, the survey also allows subcategories based on number of beds and type of other clinicians working with the CCM physician. Days off after a CCM work shift are reported as average, median, standard deviation, and 25th and 75th percentiles for shifts with at least five responses.

Results

Thirty-three academic anesthesiology departments received a data collection form. Nineteen of 33 programs completed the survey (58%), 12 departments did not respond (36%), and 2 departments (6%) indicated they could not complete the survey. One of these departments explained their set shift structure included three weeks of a mix of daytime work, weekends, nights and days off. The other department used a varying system of days or nights worked per year, to be done at the discretion of the CCM physician, thereby precluding determination of the number of days off or shifts worked per week. Of the 19 departments that completed the data collection form, 44 total ICUs were covered,

with 69 distinct CCM physician shifts. The mean time to complete the collection form per shift was 7.34 min (\pm 3.6 min), median 5 min. Overall, ten CCM physician shift types were identified and

defined by their various combination of weekday and weekend work, described in (Table 1) and visualized in (Figure 2).

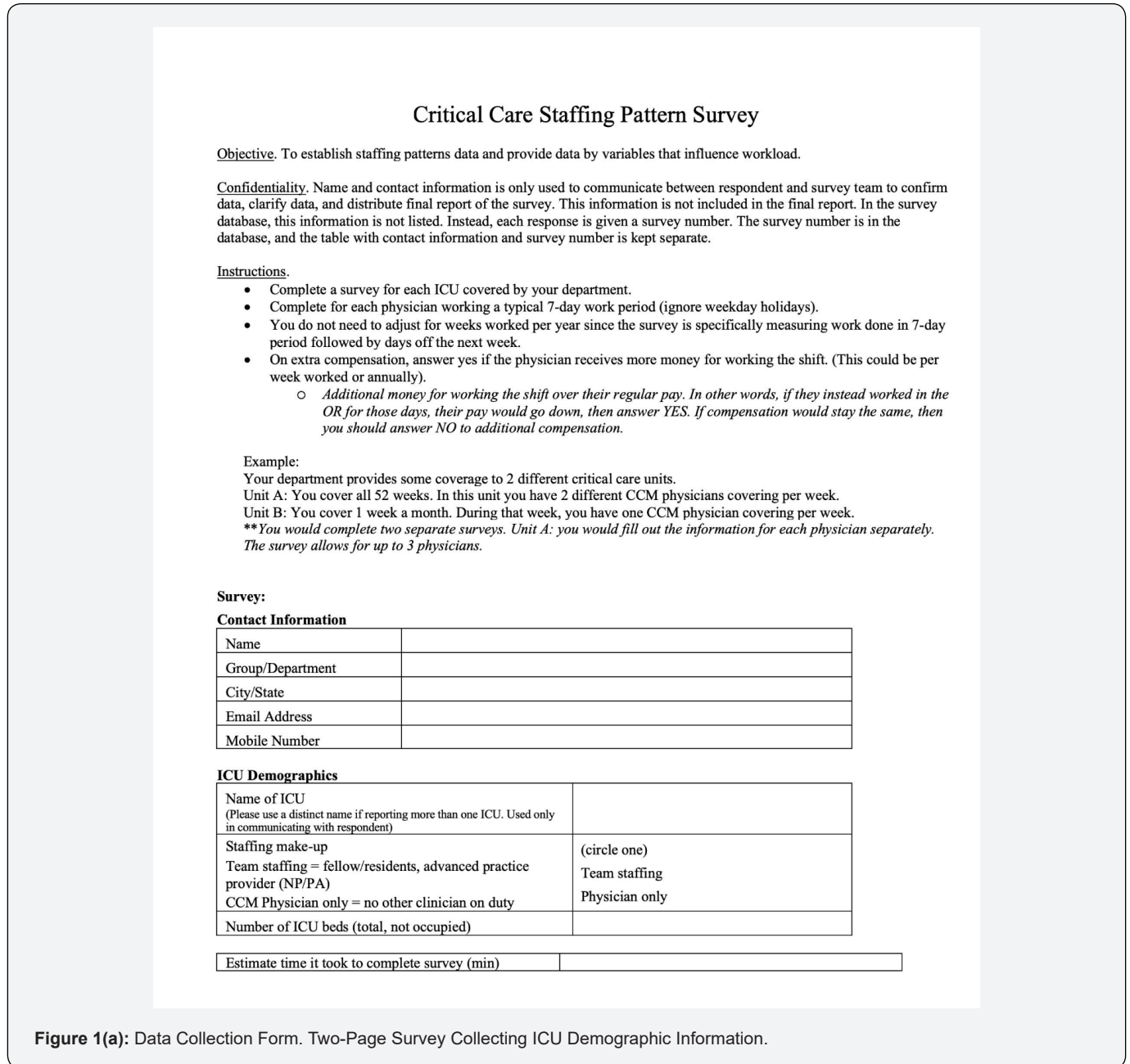


Figure 1(a): Data Collection Form. Two-Page Survey Collecting ICU Demographic Information.

Table 1: CCM Physician Shift Types. Defining the Ten Critical Care Medicine (CCM) Physician Shifts Identified After Analyzing Survey Responses by Weekday and Weekend Responsibilities.

Shifts	Weekday	Weekend
5 Days In-House, 5 Nights Home Call	Day: In-House Night: Home call	None
Weekend Days In-House, and Nights Home Call	None	Day: In-House Night: Home call

5 Weekdays In-House, Weekend In-House Day and Night	Day: In-House Night: None	Day: In-House Night: In-House
5 weekday Nights Home Call	Day: None Night: Home Call	None
In-House Every Other Night for 7 Days	Day: None Night: In-House EVERY OTHER Night	Day: None Night: In-House EVERY OTHER Night
5 Weekday Nights In-House	Day: None Night: In-House	None
5 Weekdays In-House, Weekend In-House and Home Call	Day: In-House Night: None	Day: In-house Night: Home Call
7 Nights In-House	Day: None Night: In-House	Day: None Night: In-House
7 Days In-House	Day: In-House Night: None	Day: In-House Night: None
7 Days In-House, 7 Nights Home Call	Day: In-House Night: Home call	Day: In-House Night: Home Call

ICU Name _____ Number of total beds _____

Denote with "I" if CCM physician must stay inhouse, and "H" if the CCM physician can go home.
 Note: account for all 24 hours in a typical day. More than 24 hours is possible for a "turnover" hour where two CCM physicians are working. Assumed unless marked that the CCM physician is in house during the hours and working with resident/fellow/APP.

Days off the following week.

	Physician A	Physician B	Physician C
Days off following ICU coverage: without dept duties			
Days off following ICU coverage: with only non-clinical duties (e.g., admin, education, research, etc)			
Any extra monetary compensation*			

*Additional money for working the shift over their regular pay. In other words, if they instead worked in the OR for those days, their pay would go down, then answer YES. If compensation would stay the same, then you should answer NO to additional compensation.

For a typical WEEKDAY (Monday to Friday)					For a typical WEEKEND (Saturday or Sunday)				
Time	Physician A	Physician B	Physician C	Mark if Physician only alone	Time	Physician A	Physician B	Physician C	Mark if Physician only (alone)
6:00					6:00				
7:00					7:00				
8:00					8:00				
9:00					9:00				
10:00					10:00				
11:00					11:00				
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21:00					21:00				
22:00					22:00				
23:00					23:00				
0:00					0:00				
1:00					1:00				
2:00					2:00				
3:00					3:00				
4:00					4:00				
5:00					5:00				

Figure 1(b): Hours Worked for a Typical Week of ICU Coverage.

		MON	TUE	WED	THU	FRI	SAT	SUN
SHIFT 1	DAY	IN						
	NIGHT	HOME						
SHIFT 2	DAY						IN	
	NIGHT						HOME	
SHIFT 3	DAY	IN						
	NIGHT						IN	
SHIFT 4	DAY							
	NIGHT	HOME						
SHIFT 5	DAY							
	NIGHT	IN		IN		IN		IN
SHIFT 6	DAY							
	NIGHT	IN						
SHIFT 7	DAY	IN						
	NIGHT						HOME	
SHIFT 8	DAY							
	NIGHT	IN						
SHIFT 9	DAY	IN						
	NIGHT							
SHIFT 10	DAY	IN						
	NIGHT	HOME						

Figure 2: Shift Visualization. Visual Representation of the Ten Identified Critical Care Medicine (CCM) Physician Shifts According to Today, Night, Monday Through Sunday Coverage.

Of these 69 work shifts, there were 65 shifts that involved a CCM physician working with residents, fellows, and/or APPs, and 4 “CCM physician only” shifts (Table 2). The five most prevalent shifts noted were: 7 days in house with nighttime home call (n=18), 7 days in house without nighttime work (n=17), 7 nights in house without daytime work (n=10), 5 weekdays in house with weekend in house and home call (n=8), and 5 weekday nights in house without daytime or weekend work (n=5). ICU beds according to CCM physician work shifts can be found in (Table 3). We report quantitative data for shifts with at least five responses, which included five of the ten shift types. The number of beds distribution overall and by shift reveal a trend that when a CCM physician covers the ICU for 7 days in house with 7 nights home call, the number of beds appears to be less than the other shifts identified. Given the limited number of responses in this feasibility survey, we did not perform subgroup analysis.

Days off by work shift are categorized in Supplemental (digital

content) by global setting (working with resident/fellow/APP or CCM physician only) and by shift type. This table illustrates how in a larger nationwide survey, the results could aid in documenting current trends in staffing patterns as days off according to CCM physician shift type. As in, we report quantitative data for shifts with at least five responses. Data reflected that for shifts involving 7 days of coverage (any combination of day or night), the average resulting days off ranged from 2.5 – 3.6 with a median of 3 days. Also reflected in this table is the percentage of respondents that received additional monetary compensation over their base pay for working the shift (% pay). All respondents reporting 5 nights of home call or in house every other night (total n = 5) received extra compensation. For the most common shifts reported, the percentage of respondents noting added compensation ranged from 38 to 80%. Quantifying the compensation was not asked. Supplemental (digital content) should not be considered as data for benchmarking, as that would require more than documenting current trends in staffing patterns.

Table 2: CCM Physician Shift Types by Setting. 65 Critical Care Medicine (CCM) Physician Shifts Involved Working with Residents, Fellows, And/ or APPs, and 4 Shifts Were CCM Physician Only.

Shift Type	Shift Description	Total N	Resident/ Fellow/ APP	CCM Physician Only
1	5 Days In-House, 5 Nights Home Call	1	1	0
2	Weekend Days In-House, and Nights Home Call	1	1	0
3	5 Weekdays In-House, Weekend In-House Day and Night	2	2	0
4	5 Weekday Nights Home Call	3	3	0
5	In-House Every Other Night For 7 Days	4	2	2
6	5 Weekday Nights In-House	5	5	0
7	5 Weekdays In-House, Weekend In-House and Home Call	8	8	0
8	7 Nights In-House	10	9	1
9	7 Days In-House	17	16	1
10	7 Days In-House, 7 Nights Home Call	18	18	0
	Total	69	65	4

Table 3: ICU Beds by CCM Physician Shift. Quantitative Data, For Shifts With At least Five Responses, for Critical Care Medicine (CCM) Physician Shifts According to the Number of ICU Beds Covered.

	N	BEDS					
		Mean ± SD	Min	25%tile	Median	75%tile	Max
All Work Shifts	69	21.3 ± 9.2	8	16	20	25	44
Resident/Fellow/APP	65	21.2 ± 9.4	8	15	19	24	44
CCM Physician Only (Only Clinician on Duty)	4	23.5 ± 4.0	20		23.5		27
	N	BEDS					
	N	Mean ± SD	Min	25%tile	Median	75%tile	Max
All Work Shifts							
5 Days In-House, 5 Nights Home Call	1						
Weekend Days In-House, And Nights Home Call	1						
5 Weekdays In-House, Weekend In-House Day and Night	2						
5 Weekday Nights Home Call	3						
In-House Every Other Night For 7 Days	4						
5 Weekday Nights In-House	5	28.0 ± 12.0	16		24		42
5 Weekdays In-House, Weekend In-House and Home Call	8	21.1 ± 6.7	16	16	17.5	25.75	31
7 Nights In-House	10	24.6 ± 8.0	15	18.5	24	27.75	40
7 days in-house	17	22.2 ± 9.2	8	16	20	27	40
7 days in-house, 7 nights home call	18	15.9 ± 6.7	8	10.5	14	23	28

Discussion

The proper number of days off following ICU coverage remains an enigma. Because of the apparent countless variations of CCM physician staffing models, collecting data via surveys has been difficult. Unlike other surveys, we created a data collection form that allowed us to analyze the data and subsequently categorize shifts, rather than predetermine shift categories. Our goal in this feasibility study was to determine if our novel form

would result in meaningful data collection and allow for staffing model comparisons and defining of days off after a variety of CCM physician work shifts. Our results should not be extrapolated to national data. We do not include the geographical distribution of departments completing the survey, as we did not design the study to be randomized nor represent all geographical areas.

Time “off” from work can be thought of in multiple ways time to recover; a form of compensation; nonclinical time to develop

professionally through academic pursuits such as research, regional or national society involvement, curricula development; or time off without clinical or administrative responsibilities allowing for one to seek personal bliss. Recovery from night in housework is different than night at homework or day work and as such requires different time allocations. Monetary compensation was partially addressed on the data collection form by asking if additional money was provided for working the ICU shift beyond their base pay. As the survey population consisted of anesthesiologist CCM physicians, another way to think of this question was to compare if they instead worked in the operating room for those shifts would their pay decrease (YES) or remain the same (NO). There is significant heterogeneity in CCM physician work shifts and the benefits of one staffing model over another have not been noted [5,6].

While there are no guidelines or a preferred staffing model, the Society of Critical Care Medicine (SCCM) and American College of CCM have commented that an ideal ICU model should have a dedicated CCM physician 24/7, especially for high acuity, high volume units [7]. However, implementation of 24/7 CCM staffing requires extensive institutional support. Regardless of staffing model, the presence of a CCM physician and multidisciplinary team has been found to reduce mortality rates and shorten ICU lengths of stay for a subset of units. Greater attention has been focused on the impact that CCM staffing models have on the CCM physician due to the growing recognition of burnout syndrome, especially within high acuity professions. In 2016, the SCCM created a task force that among other goals, was tasked to review issues related to critical care workload and burnout syndrome. As predicted, ICU strain and increased staff workload, especially when patient to CCM physician ratio exceeds 15:1, may negatively impact wellness and is independently associated with symptom intensity.

Several studies have noted that volume and timing of clinical work, especially a heavy night shift burden or the number of consecutive days worked, are key factors that influence burnout likelihood. Future considerations for modifying staffing models, especially as a 24/7 model becomes more commonplace, should include strategies to reduce ICU workforce burden and decrease burnout rates. Our survey uniquely categorized results into several general work shifts after survey completion, due to collecting data specifically by hours worked and if the CCM physician was in house. Asking respondents to select from a list of pre-determined shifts was deemed less accurate since there is no standard ICU shift, and doing so might have led to fewer surveys being completed. We anticipate that after analyzing results of a national survey, there will be more work shift categories than the ten identified (e.g., tele ICU), although the ten defined are likely the most common.

Shaefi et al provides valuable data from their national clinical practice pattern survey of anesthesia CCM physicians. They report

~82% of respondents work in an academic practice (residents, fellows, APP), similar with our pilot data of 87%, with only ~2% in CCM physician only care as compared to our 6%. Most notably ~10% reported tele ICU coverage, which is not reflected in our data, nor is coverage at night with less consecutive days – like operating room call coverage. Like our data results, the most common nighttime coverage model was shifting based work within house coverage 24/7, followed closely by a nighttime home call after in house coverage model. Despite our limited and nonrandom data, the results appear like those found with a broader national survey.

Data from a national survey is anticipated to add value for leadership (e.g., department chairs, CCM division chiefs, and hospital/medical school executives) as it may help further elucidate an FTE for a CCM physician, aid in adjusting compensation to compete with the market of critical care staff and allow for appropriate time off. While benchmarking days off by shift type is an ideal goal, it presumes that current staffing patterns are appropriate for the work being done. In the proposed national survey, we aim to analyze for trends or any variation within a work shift. Additionally, with potentially more work shift categories to compare, there may be a stronger relationship between the number of beds and days off within a work shift category. At this time, no definitive conclusions should be made from the data collected. We believe this feasibility study demonstrates that our novel data collection tool allowed for expeditious data collection and results that may contribute towards analysis of staffing pattern trends of shift types and time off per work shift.

Our next step is working with the American Society of Anesthesiology's CCM Committee to facilitate a national survey of anesthesiology departments. Starting data collection with academic departments is anticipated to be straightforward as chairs are readily identifiable. In addition, this approach may prevent data duplication by having division chiefs complete a survey for each unit staffed, rather than pursuing individual CCM physicians from CCM societies distribution lists.

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