

Perceptions and Practices Regarding Sleep in the Intensive Care Unit

A Survey of 1,223 Critical Care Providers

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Abstract

Rationale: Poor sleep affects a majority of critically ill patients and is believed to be associated with adverse intensive care unit (ICU) outcomes such as delirium. While recent guidelines recommend sleep promotion efforts to improve delirium and other ICU outcomes, little is known about critical care providers' beliefs regarding sleep in the ICU.

Objectives: To evaluate providers' perceptions and practices regarding sleep in the ICU.

Methods: From April to July 2014, the Sleep in the ICU Survey was disseminated to ICU providers via institutional e-mail lists and four international critical care society distribution lists.

Measurements and Main Results: A total of 1,223 surveys were completed by providers from 24 countries. Respondents were primarily nurses (59%) or physicians (39%). Most respondents indicated that ICU patients experienced "poor" or "very poor" sleep

(75%) and that poor sleep could affect the ICU recovery process (88%). Respondents also felt that poor sleep was associated with negative ICU outcomes such as the development of delirium (97%), longer length of stay (88%), poor participation in physical therapy (87%), and delayed liberation from mechanical ventilation (83%). The minority (32%) of providers had sleep-promoting protocols; these providers tended to believe their patients slept longer and experienced better sleep quality.

Conclusions: Though most clinicians believe that sleep in the ICU is poor and adversely affects patient outcomes, a minority of the ICUs represented by our respondents have sleep promotion protocols. These findings highlight discordant provider perceptions and practices surrounding sleep in the ICU, as well as a possible lack of available evidence-based guidelines for promoting sleep in the ICU.

Keywords: sleep; critical care; delirium; intensive care unit; healthcare survey

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Decades of research have consistently identified poor sleep as a common and potentially deleterious issue affecting patients in the intensive care unit (ICU) (1). Studies using polysomnography have demonstrated that critically ill patients experience decreased total sleep time, increased sleep during daytime hours (circadian misalignment), frequent arousals from sleep, and abnormal sleep architecture with reduced or absent slow wave sleep and REM stages (2–6).

While various factors inherent to critical illness, such as severity of disease, mechanical ventilation, pain, and anxiety, likely contribute to sleep disruption in the ICU, a number of modifiable factors also disrupt sleep, including loud noises, bright lights, frequent nocturnal patient care interactions, and common ICU medications such as benzodiazepines and opioids (5, 7–10). As a result, critically ill patients often experience significantly worse sleep in the ICU than at home (11) and report disrupted sleep as a major source of anxiety and stress during their ICU stay (12, 13).

The influence of sleep on ICU outcomes and the post-ICU recovery process remains largely unexplored. Studies in non-critically ill patients have suggested that sleep disruption, including circadian misalignment, plays a potentially important role in a number of physiological processes, including respiratory muscle (14) and hemodynamic (15) function, host defense (16), stress (17), and glucose metabolism (18).

In particular, a wealth of recent literature has highlighted poor sleep as a potentially important modifiable risk factor for ICU delirium (19) and its associated consequences, including prolonged length of stay, long-term cognitive and physical impairments, and increased 1-year mortality (20, 21). Poor sleep may impact delirium in a number of ways, such as by impairing early mobilization efforts in the ICU (22), prolonging ventilator weaning (23), and augmenting the consequences of persistent bed rest (24).

With advances in critical care leading to improvements in ICU mortality, attention is now being placed on efforts to prevent disabling short- and long-term impairments common after ICU discharge (25, 26). As part of these efforts, interventions to promote sleep in the ICU have gained particular interest and are therefore strongly recommended in recent

clinical practice guidelines of the Society of Critical Care Medicine (SCCM) (27). Moreover, recent meta-analyses suggest that sleep-promoting interventions may improve sleep quantity and quality in critically ill patients (28).

Despite such guidelines and synthesized evidence, there are no published data regarding collective efforts of ICUs to implement sleep-promoting interventions. Additionally, to our knowledge, there have been no studies evaluating practitioners' general beliefs regarding sleep in the ICU.

Given that a lack of awareness and performance measures pose common barriers to guideline implementation (29), a detailed assessment is necessary to evaluate current provider perceptions and behaviors surrounding sleep and the consequences of sleep disruption in the ICU. Hence, in this study, we evaluated practitioners' perceptions and practices regarding sleep in the ICU by administering the Sleep in the ICU Survey (SLEEPii) to a large population of ICU healthcare providers.

Methods

Survey Administration

From April to July 2014, we administered a SLEEPii Survey to a convenience sample of critical care clinicians across North America, South America, Europe, Asia, and Australia. Eligible participants included physicians, nurses, nurse practitioners, and physician assistants currently working in ICUs with at least six beds. Providers working in nonadult (i.e., neonatal or pediatric) ICUs were excluded. A waiver of institutional review board approval was obtained through Yale University, the study's central coordinating site, and obtained, as necessary, by institutional review boards of other participating sites.

This voluntary and anonymous web-based survey was developed and disseminated using Qualtrics (www.qualtrics.com) and hosted by Yale University. Survey participation was requested via institutional e-mail lists and member distribution lists of the American Thoracic Society (www.thoracic.org), the SCCM (www.sccm.org), the American College of Chest Physicians (www.chestnet.org), and the American Association of Critical Care Nurses (www.aacn.org).

Survey Design and Development

The SLEEPii Survey assessed provider perceptions and behaviors surrounding sleep in the ICU setting (*see* online supplement). Survey questions were generated by a multidisciplinary panel of members from the Sleep in the ICU Task Force. Survey development was guided by independent experts in survey design (*see* ACKNOWLEDGMENTS before the REFERENCES). Following survey creation, panel members recruited 79 ICU providers to perform survey pilot testing. Feedback and suggestions were then used to modify the original survey. Providers who participated in pilot testing were excluded from final survey participation.

The final survey collected information on provider demographics and practice characteristics, and included 13 questions regarding provider perceptions of the importance of sleep in the ICU, quality and quantity of sleep in the ICU, and sleep-promoting interventions in the ICU, including perceptions of pharmacological sleep aids. Surveys were considered complete if respondents clicked "Finish" at the end of the survey, regardless of number of missing responses.

Statistical Analysis

Raw survey data were downloaded from Qualtrics and summarized using Excel 2010 software (Microsoft, Redmond, WA). To compare responses of practitioners with sleep protocols in their ICUs against those without, we performed Student's *t* tests for continuous variables and χ^2 tests for categorical variables using STATA version 14.0 software (StataCorp, College Station, TX). Statistical significance was defined as a two-sided *P* value less than 0.05.

Results

Survey Collection and Participant Characteristics

Of 1,519 surveys initiated online, 1,223 (81%) were completed and included for analysis. Among the completed surveys, response rates for individual questions ranged from 96% to 100%. Surveys were submitted from North America (1,109 surveys completed of 1,327 initiated; 84% completion rate), Europe (73 of 76 completed; 96%), Asia (20 of 22 completed; 91%), South America (15 of 19 completed;

79%), and Australia (1 of 2 completed; 50%). Participants not reporting continent completed 5 (7%) of 73 surveys. Among the 24 countries represented, the majority of respondents were from the United States (89%; n = 1088), France (5%; n = 61), Canada (2%; n = 21), and Brazil (1%; n = 15). Responders reported accessing the survey via an e-mail link provided by their local institution (60%) or through links offered by the American College of Chest Physicians (15%), the American Thoracic Society (6%), and the Association of Critical Care Nurses (0.4%), as well as from other sources (18%).

The 1,223 respondents completing surveys included 727 (59%) nurses and 474 (39%) physicians. A total of 754 (62%) respondents were women. The majority of respondents worked primarily in an academic medical center (711 of 1,223; 58%), in a nonsurgical ICU setting (867 of 1,223; 71%), had practiced for at least 6 years (742 of 1,210; 61%), and worked in an ICU with more than 20 beds (631 of 1,196; 53%) (Table 1).

Perceptions of Sleep in the ICU

A majority (75%; 901 of 1,207) of respondents rated their patients' actual sleep as "poor" or "very poor" in the ICU setting, with 65% (781 of 1,192) estimating that their patients obtained less than 6 hours of sleep per day (Table 2). Only a small minority of respondents felt this quantity of sleep was sufficient for their patients (5%; 57 of 1,191). A substantial proportion of respondents believed that patients' sleep in the ICU was very or extremely important (81%; 980 of 1,206) and that poor sleep could affect the ICU recovery process (88%; 1,116 of 1,214) (Table 2). More specifically, the vast majority of respondents felt that poor sleep in the ICU was associated with the development or persistence of delirium (97%; 1,168 of 1,207), depression (89%; 1,073 of 1,207), longer hospital length of stay (88%; 1,065 of 1,207), ability to participate in physical therapy (87%; 1,055 of 1,207), and liberation from mechanical ventilation (83%; 1,001 of 1,207). Measuring vital signs, noise levels, ventilator management and/or suctioning, and medication administration were ranked by respondents as the top four factors disturbing patient sleep in the ICU setting (Table 3).

Table 1. Respondent characteristics (n = 1,223)

Characteristics	Data*
Type of Healthcare Professional	
Physician	474 (39%)
Nurse	727 (59%)
Nurse practitioner or physician assistant	18 (1%)
Other	4 (0%)
Age, yr, mean (SD)	40 (11)
Female sex	754 (62%)
Main practice setting	
Academic medical center	711 (58%)
Nonacademic medical center	512 (42%)
Area of expertise ^{†,‡}	
Medical	867 (71%)
Surgical	347 (29%)
Years of practice [†]	
<5	468 (39%)
6–10	290 (24%)
>10	452 (37%)
Mostly working nights	463 (38%)
Geographical practice location [†]	
North America	1,109 (91%)
Europe	73 (6%)
Asia	20 (2%)
South America	15 (1%)
Australia	1 (0%)
Number of beds in responder's ICU [†]	
1–10	88 (7%)
11–20	477 (40%)
>20	631 (53%)
Sleep-promoting protocol present in responder's ICU ^{†,§}	391 (32%)
If protocol present, for how long?, yr, mean (SD)	2 (2)

Definition of abbreviation: ICU = intensive care unit.

*Values represent responses and proportion of responses unless noted otherwise. Percentages may not add up to 100% due to rounding.

[†]Total responses do not equal 1,223, since not all respondents answered the question.

[‡]"Surgical" includes reported training in surgical-critical care or anesthesia; all other training categories are included under "Medical."

[§]As of July 2014.

Interventions to Improve Sleep in the ICU

Regarding behaviors to promote sleep in the ICU setting, nearly half (49%; 590 of 1,212) of respondents agreed that allowing uninterrupted blocks of time to sleep was the intervention with the most potential to improve patient sleep in the ICU, while a minority (9%; 113 of 1,212) suggested prioritizing lighting changes to promote sleep (Table 4). Activities that respondents had the least confidence in being able to perform (1–10 Likert scale, with 1 equaling "never" and 10 equaling "always") were as follows: controlling environmental noise levels (47% of ratings ≤ 5), assessing if patients were sleeping enough (43%), and adjusting ventilators to promote sleep (41%). Regarding administration of medications to promote sleep, nearly half (48%; 574 of 1,194) of respondents estimated that 25% or less of their patients

received medications for sleep, while 18% (224 of 1,194) estimated that at least 50% of their patients received medications for sleep.

Responses Based on Presence of an ICU Sleep Protocol

A minority of respondents (32%; 391 of 1,206) reported having established sleep-promoting protocols in their ICUs (Table 1). When present, the protocols had been in place for a mean (SD) of 2 (± 2) years. As compared with those without established protocols, practitioners with established protocols in their ICUs felt their patients experienced better sleep quality (131 [34%] of 391 vs. 174 [21%] of 815 rating their patients sleep as "fair, good, very good, or excellent"; $P < 0.001$) and slept slightly more during a 24-hour day in the ICU (Table 2). Those without sleep protocols felt noise was the factor most likely to disturb sleep in their ICU patients,

Table 2. Perceptions of sleep in the intensive care unit

Question	All Respondents*	Sleep Protocol in ICU		P Value†
		Yes (n = 391)	No or Unknown (n = 815)	
In a 24-h day in the ICU, how many hours ...				
Do your patients sleep? n = 1,192				
<4	182 (15%)	46 (12%)	134 (17%)	0.01
≥4 and <6	599 (50%)	182 (47%)	412 (52%)	
≥6 and <8	277 (23%)	105 (27%)	171 (21%)	
≥8	134 (11%)	51 (13%)	82 (10%)	
Mean (SD)	5.2 (2.0)	5.5 (2.5)	5.1 (2.2)	0.001
Of dedicated sleep are sufficient for your patients? n = 1,191				
<6	57 (5%)	17 (4%)	40 (5%)	0.14
≥6 and <8	450 (38%)	131 (34%)	316 (40%)	
≥8	684 (57%)	236 (61%)	442 (55%)	
Mean (SD)	7.6 (2.0)	7.7 (1.7)	7.6 (1.6)	0.17
Of sleep can be realistically achieved by your patients? n = 1,184				
Less than 6	535 (45%)	160 (42%)	370 (47%)	0.21
≥6 and <8	489 (41%)	163 (43%)	325 (41%)	
≥8	160 (14%)	59 (15%)	99 (12%)	
Mean (SD)	5.5 (2.0)	5.7 (1.8)	5.5 (1.6)	0.08
Rate the overall quality of sleep while your patients are in the ICU, n = 1,207				
Very poor	233 (19%)	51 (13%)	181 (22%)	<0.001
Poor	668 (55%)	205 (53%)	454 (56%)	
Fair	275 (23%)	117 (30%)	157 (19%)	
Good, very good, or excellent	31 (3%)	14 (4%)	17 (2%)	
How important is it that your patients sleep while in the ICU? n = 1,206				
1 (unimportant) or 2 or 3	59 (5%)	14 (4%)	43 (5%)	0.48
4 (moderately important)	167 (14%)	54 (14%)	111 (14%)	
5 (very important)	447 (37%)	137 (36%)	304 (38%)	
6 (extremely important)	533 (44%)	178 (46%)	347 (43%)	
Do you believe that poor sleep could affect critically ill patients' recovery? n = 1,214				
Yes	1,116 (88%)	358 (92%)	749 (92%)	0.09
No	4 (0%)	3 (1%)	1 (0%)	
Maybe	83 (7%)	29 (7%)	52 (6%)	
Do not know	11 (1%)	1 (0%)	10 (1%)	
What aspects of patient recovery are adversely affected by poor sleep in the ICU? n = 1,207				
Development or persistence of delirium	1,168 (97%)	381 (97%)	777 (95%)	0.08
Development of depression	1,073 (89%)	343 (88%)	722 (89%)	0.66
Hospital length of stay	1,065 (88%)	341 (87%)	714 (88%)	0.85
Ability to participate in physical therapy	1,055 (87%)	342 (87%)	703 (86%)	0.56
Liberation from mechanical ventilation	1,001 (83%)	323 (83%)	669 (82%)	0.82
Ability to fight off infection	935 (77%)	315 (81%)	613 (75%)	0.04
Ability to heal wounds	833 (69%)	286 (73%)	540 (66%)	0.02
Survival	646 (54%)	217 (56%)	423 (52%)	0.24

Definition of abbreviation: ICU = intensive care unit.

*Total responses do not total 1,223 because not all respondents answered the question. Percentages represent proportion of responses to completed questions.

†Calculated using Student's *t* test for continuous variables and χ^2 tests for categorical variables.

while those with established protocols ranked noise third ($P = 0.008$) behind vital sign measurement and ventilator management and suctioning (Table 3).

Additionally, compared to those without protocols, practitioners with established sleep protocols felt they could better assess whether their patients were sleeping enough, control

lighting conditions and environmental noise levels, delay nonemergency disturbances to allow their patients to sleep, adhere to a clustered ICU sleep protocol, and create dedicated sleeping conditions for stable patients (Table 4). A sensitivity analysis excluding responses for practitioners whose sleep protocols were "unknown" (i.e., comparing

only "yes" vs. "no" responses) did not significantly change the results.

Discussion

To our knowledge, this study represents the first large-scale evaluation of ICU healthcare

Table 3. Perceived causes and consequences of sleep disturbances in the intensive care unit

Factors Disturbing Sleep in the ICU	All Respondents		Sleep Protocol in ICU				P Value [†]
	Average Rank*	Rank	Yes (n = 388)		No or Unknown (n = 799)		
			Average Rank*	Rank	Average Rank*	Rank	
Measuring vital signs	3.82	1	3.79	1	3.83	2	0.81
Noise levels	3.97	2	4.29	3	3.80	1	0.01
Ventilator management/suctioning	4.24	3	4.11	2	4.31	4	0.16
Medication administration	4.27	4	4.33	4	4.24	3	0.58
Light levels	5.96	5	6.21	6	5.82	5	0.05
Patient repositioning	6.08	6	5.65	5	6.25	6	0.001
Physical examination by providers	6.35	7	6.28	7	6.40	7	0.45
Radiographic studies	6.63	8	6.56	8	6.69	8	0.39
Bathing	7.88	9	8.07	10	7.80	9	0.06
Wound care	8.10	10	8.05	9	8.13	10	0.53
Visitation from family and friends	8.87	11	8.84	11	8.90	11	0.70

Definition of abbreviation: ICU = intensive care unit.

Rankings range from most important (1) to least important (11).

*Average ranking for each factor by 1,197 (of 1,223 total) participants who completed the ranking list. Of 1,206 participants who responded yes, no, or unknown, 1,187 completed the ranking list question.

[†]Mean rankings compared using Student's *t* test.

providers' perceptions and practices surrounding sleep in the ICU. Our survey of 1,223 healthcare providers demonstrated that a strong majority of respondents recognized the importance of sleep in the critically ill and acknowledged the presence of sleep disruption in the ICU.

Additionally, nearly all respondents felt poor sleep could affect the ICU recovery process; lead to the development of delirium; and adversely affect participation in physical therapy, weaning from mechanical ventilation, and length of stay. Despite the value placed on sleep in the ICU by clinicians, only 32% of ICU providers reported the presence of a sleep-promoting protocol for patients in their ICUs.

The results of this SLEEPii Survey demonstrate that practitioners are aware of decreased sleep quality and quantity in the ICU and, in line with current literature, categorize sleep in this setting as "poor" or "very poor" (3, 6). Respondents at institutions with established protocols did believe that their patients experienced higher-quality and slightly longer sleep than those without protocols. Additionally, our respondents felt that sleep duration was important or very important for patients. Factors inherent to critical illness, such as severity of disease, mechanical ventilation, pain, and anxiety, as well as a number of modifiable factors, including loud noises, bright lights, frequent nocturnal patient care interactions, and commonly prescribed

ICU medications such as benzodiazepines and opioids have been reported to disturb sleep in the ICU (5, 7–10). Our respondents most commonly listed noise, suctioning, ventilator management, and medication administration as the major contributors to sleep disruption in their ICU.

Practitioners completing our survey also reflected insight into the potential consequences of poor sleep in the ICU, including delirium, longer length of stay, and duration of mechanical ventilation. Our respondents also noted that decreased participation in physical therapy was a possible consequence of poor sleep in the ICU.

While recent studies have demonstrated reductions in delirium and length of stay as a result of ICU early mobilization practices (23, 30), the specific interplay among sleep, delirium, and mobilization remains largely unknown. A possible physiological link of sleep with mobility may involve increased exposure to circadian entrainment cues (zeitgebers), which, in the case of ICU mobility, include higher daytime light levels, increased exercise, and appropriately timed "social interaction." Properly timed circadian cues are well demonstrated to improve day-night orientation and to promote sleep at the correct physiological time (31).

The provision of uninterrupted blocks of time for sleep was the most common survey response to the question, "What is the one thing that you believe may improve

your patients sleep in the ICU?" Some studies involving environmental, nonpharmacological (i.e., ear plugs, eye masks, and/or music), and/or pharmacological interventions to promote sleep have demonstrated reductions in delirium and coma in the ICU (32). These findings highlight a potential association between sleep and outcomes in the ICU, along with the feasibility and potential benefits of "bundled" sleep improvement efforts.

On the basis of our survey, a minority of patients appear to be receiving medications for sleep. Eighteen percent of respondents reported that 50% or more of their patients received unspecified sleep medications; nearly one-half (48%) of respondents reported that less than 25% of their patients received any medications for sleep. Prescribing practices did not vary between survey respondents from institutions with and without sleep promotion protocols.

While SCCM guidelines recommend sedation strategies using nonbenzodiazepine agents (i.e., propofol or dexmedetomidine) over benzodiazepines, there are currently no recommendations regarding medications to promote sleep in the ICU. From a pharmacological standpoint, benzodiazepines and opioids have been shown to negatively impact sleep architecture (10). Emerging therapies such as melatonin and dexmedetomidine have shown improvement only in sleep

Table 4. Perceptions and practices surrounding sleep promotion in the intensive care unit

Question	All Respondents*	Sleep Protocol in ICU [†]		P Value [‡]
		Yes (n = 386)	No or Unknown (n = 810)	
What is the one thing that you believe may improve your patients' sleep in the ICU? n (%)				
Allowing patients blocks of uninterrupted sleep time	590 (49%)	182 (47%)	404 (50%)	0.63
Noise control	225 (19%)	67 (17%)	157 (19%)	
Keeping patients physically active during the day so they are more tired for sleep at night	128 (11%)	45 (12%)	82 (10%)	
Keeping the ICU dark at night and bright during the day	113 (9%)	36 (9%)	75 (9%)	
Keeping patients awake during the day so they are more tired for sleep at night	66 (5%)	27 (7%)	39 (5%)	
Medication prescribed for sleep	38 (3%)	14 (4%)	23 (3%)	
Other/do not know	45 (4%)	15 (4%)	30 (4%)	
What percentage of your patients receive medications for sleep?				
0–25%	574 (48%)	182 (48%)	387 (48%)	0.98
26–50%	377 (32%)	124 (33%)	250 (31%)	
51–75%	137 (11%)	41 (11%)	95 (12%)	
76–100%	87 (7%)	28 (7%)	59 (7%)	
Do not know	19 (2%)	6 (2%)	13 (2%)	
Rate whether you can do the following, 1 = never, 10 = always, mean (SD)				
Assess whether patients are sleeping enough	6.1 (2.4)	6.5 (2.4)	5.9 (2.4)	<0.001
Control lighting conditions to allow patients to sleep	6.7 (2.6)	7.1 (2.2)	6.5 (2.4)	<0.001
Control environmental noise levels to allow patients to sleep	5.7 (2.5)	6.0 (2.2)	5.5 (2.3)	<0.001
Adjust the ventilator or bilevel PAP to allow patients to sleep	6.0 (2.6)	5.9 (2.5)	6.0 (2.4)	0.75
Delay nonemergency disturbances to allow patients to sleep	6.5 (2.5)	6.8 (2.2)	6.3 (2.3)	<0.001
Adhere to a clustered sleep protocol designed for the ICU	6.6 (2.5)	7.2 (1.9)	6.4 (2.3)	<0.001
Temporarily suspend visitation to allow for sleep	6.2 (2.9)	6.4 (2.7)	6.2 (2.7)	0.26
Create conditions for a dedicated sleeping time for stable patients	6.7 (2.4)	7.1 (2.0)	6.5 (2.2)	<0.001

Definition of abbreviations: ICU = intensive care unit; PAP = positive airway pressure.

*Total responses do not total 1,223 because not all respondents answered the question. Percentages represent proportion of responses to completed questions.

[†]Of 1,206 participants who responded yes, no, or unknown, 1,196 completed at least one question. Responses not totaling 1,196 are due to missing responses.

[‡]Calculated using Student's *t* test for continuous variables and χ^2 tests for categorical variables.

efficiency, but they have not been studied extensively in critically ill populations (33, 34). Notably, daily interruption of sedating medications remains the only ICU pharmacological strategy leading to increased slow wave and REM sleep (35). Ascertaining which specific medications practitioners are prescribing for sleep would be an important target for future investigations.

The 2013 SCCM clinical practice guidelines for the management of pain, agitation, and delirium in the ICU recommend promoting sleep in adult ICU patients by using a multifaceted, bundled approach aimed at addressing modifiable

disruptors of nighttime sleep in the inpatient setting (27, 32), including environmental noise and light reduction via "quiet time" protocols (36–41); clustering of patient care activities (36); and consideration of earplugs, eye masks, or soothing music (36, 42–46).

Despite these guidelines and the widespread belief of survey participants that poor sleep may negatively influence ICU patient outcomes, only one-third of our respondents reported the presence of sleep-promoting protocols at their institution. Respondents expressed only modest confidence in their ability to foster a sleep-friendly ICU environment and implement clustered sleep promotion protocols.

This disconnect between perception of the importance of sleep and the sleep-promoting efforts likely reflects both the perceived efficacy and effort needed to achieve and maintain changes in care (e.g., clustering of care, altered work flows) and ICU environment (e.g., sound and light). Complex and costly environmental interventions cannot be justified without high-level evidence to justify the cost (28, 36). Additionally, complex environmental interventions cannot be instituted on an individual level (1, 32, 47).

As demonstrated in prior successful interventions (48, 49), sleep promotion requires a coordinated and dedicated effort

to implement and sustain complex interventions, along with a fundamental culture and behavior change within the ICU care structure (50). The number of staff affecting patient sleep is large, and stakeholders ranging from the ICU director to facilities staff would need to alter workflow to support such interventions.

Strengths of our study include administration of an extensive survey among a diverse population of domestic and international practitioners. Our questionnaire underwent a rigorous development process, with guidance of a survey methodologist, pilot testing, and iterative redesign before formal distribution. In addition, the majority of the surveys that were initiated were completed and provided data for analysis, as all questions had a 96% to 100% response rate.

Limitations

Our study had several limitations. First, the survey was restricted to the English language and web-only access. Moreover, our respondents were predominantly North American and European providers in professional critical care networks and within the institutions represented by members of the Sleep in the ICU Task Force. Therefore, the results may not be generalizable to a broader ICU provider population.

Second, to reach a wide international critical care provider population, we distributed our survey via institutional mailing lists, critical care society membership lists, and as a link forwarded to contacts of our task force. However, because the institutional lists and participating professional societies did not share the identities, locations, or number of members on these lists, and since we did not know the degree of overlap between these lists, we could not determine a raw response rate for

this survey. However, the 81% completion rate of initiated surveys by a global practitioner population, along with a high question response rate, suggests that the survey was generally acceptable and comprehensible to respondents.

Third, similar to previous survey-based studies of ICU provider perceptions and practices (51, 52), we did not ask respondents to provide detailed demographic and/or clinical information regarding their ICU patient populations. Given our heterogeneous responder population, we felt such survey data would be infeasible to collect and would be susceptible to respondent fatigue and incorrect data. For similar reasons, we did not ask respondents to describe their sleep promotion protocols or perceived barriers to protocol implementation. Nevertheless, we believe our study provides an important foundation for future work to explore ICU provider awareness surrounding sleep and its implications for ICU practice.

Conclusions

Our survey highlights a striking gap between the high importance practitioners place on sleep in the ICU and the relatively low rate of implementation of sleep-promoting protocols at the institutions of those surveyed. Moreover, at institutions reporting protocols for sleep, total estimated sleep time was short. Hence, implementation of interventions to promote sleep in the ICU is complex and requires multidisciplinary involvement of ICU and hospital leadership and staff. In providing a snapshot of current attitudes and behaviors surrounding sleep in the ICU setting, this survey provides a knowledge base for future studies involving sleep in critically ill patients and informs strategies for future ICU-based sleep promotion efforts. ■

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