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Kevin Stiver

Ohio State University Medical Center, kevin.stiver@ohiohealth.com

Nandini Sharma

nandini.sharma@osumc.edu

kayla geller

kayla.geller@osumc.edu

lisa smith

lisa.smith2@osumc.edu

julie stephens

julie.stephens@osumc.edu

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## **Authors**

Kevin Stiver, Nandini Sharma, kayla geller, lisa smith, julie stephens, emile daoud, susan moffatt-bruce, and ernest mazzafferri

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Kevin Stiver MD, *Division of Cardiovascular Medicine, The Ohio State University Medical Center, Kevin.stiver@ohiohealth.com*

Nandini Sharma MD, *College of Medicine, The Ohio State University, nandini.sharma@osumc.edu*

Kayla Geller BSN, *College of Nursing, The Ohio State University Medical Center, kayla.geller@osumc.edu*

Lisa Smith BSN, *College of Nursing, The Ohio State University Medical Center, lisa.smith2@osumc.edu*

Julie Stephens MS, *Center for Biostatistics, The Ohio State University, julie.stephens@osumc.edu*

Emile Daoud MD, *Division of Cardiovascular Medicine, The Ohio State University Medical Center, emile.daoud@osumc.edu*

Susan Moffatt-Bruce MD PhD, *Department of Surgery, The Ohio State University Medical Center, susan.moffatt-bruce@osumc.edu*

Ernest Mazzaferri MD, *Division of Cardiovascular Medicine, The Ohio State University Medical Center, ernest.mazzaferri@osumc.edu*

### Abstract

Obtaining middle of the night vital signs is disruptive to sleep and not founded on evidence-based medicine. We sought to investigate the perception of quality of sleep and overall satisfaction during a hospital stay between an intervention group where overnight night vital signs were not obtained and a standard of care group where overnight vital signs were obtained every four hours. We also monitored for adverse events in the intervention and standard group. Low-risk observational stay patients with a planned cardiac procedure were eligible for this study. After consent, patients were randomized to the intervention or standard group. Participants were provided a questionnaire on the day following their overnight stay to assess their perception of quality of sleep and satisfaction with their hospital stay. Charts were reviewed to assess for any adverse outcomes. During the study period, 39 patients were enrolled in the standard group and 41 in the intervention group. All patients were discharged the following day as planned and no adverse events occurred overnight. More patients in the standard group rated good/excellent sleep at home, and more patients in the intervention group rated good/excellent sleep in the hospital. There was a trend toward less disruptive sleep between home and hospital for the intervention group ( $p = 0.096$ ). There was no difference found in the overall satisfaction of hospital stay response between the intervention and standard groups ( $p = 0.999$ ). Fewer patients in the intervention group had worse sleep in the hospital as compared to home, significant at  $p < 0.10$ . We also found there was no escalation of care despite not obtaining vitals throughout the night in our intervention group. With this proof of concept now safely implemented, it is our intention to implement further studies to broaden our inclusion criteria and population to encourage a restful and healing environment through the entire healthcare stay.

### Keywords

Quiet at night, patient satisfaction, nursing intervention, outcomes

### Note

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### Introduction

Nearly all hospitalized patients are subjected to routine vital sign monitoring. The frequency at which vital signs are obtained is not based on evidence and usually occurs at intervals regardless of the level of severity of illness<sup>1,2</sup>. Healthcare in the United States lacks an evidence-based guideline on this practice but most hospitals have a policy of taking inpatient vital signs every 4 to 6 hours<sup>1</sup>. As such,

most patients will have at least one set of vitals taken in the middle of the night, thus introducing the possibility of sleep disruption.

Previous studies have shown that patient perception of sleep quality is often worsened by sleep interruption from human and environmental disturbances<sup>3-6</sup>. In fact, the most disruptive intervention on quality of sleep has been found to be the act of obtaining vital signs.<sup>4</sup> Furthermore,

interruption of sleep has been found to increase daytime somnolence, worsen pain, worsen cardiorespiratory status, and adversely affect the mental well being of the ill patient<sup>6-8</sup>.

Few studies have investigated the medical necessity for obtaining vital signs at specific intervals, particularly in the middle of the night<sup>2</sup>. One of the published studies examining this important issue found vital signs taken throughout the night only rarely necessitated an intervention<sup>9</sup>, and another found nighttime assessment to not be a good screening tool for clinical instability<sup>10</sup>. These studies, however, did not examine the effect of the intervention from the patient’s perspective.

Herein, we report our findings from a prospective, randomized pilot study involving a modified overnight vital sign program at our institution in low-risk patients. Along with monitoring for safety, our primary outcomes were the perception of quality of sleep and overall satisfaction during a hospital stay.

**Methods**

**Study population and recruitment**

Adult patients scheduled for a planned percutaneous coronary intervention, implantable cardioverter-defibrillator (ICD), atrial fibrillation ablation, or pacemaker placement were deemed to be low-risk for clinical decline and were eligible to participate in this study. This study was approved by our institution’s review committee for clinical research. Patients were excluded if their pre-procedural vital signs fell within a certain pre-determined range that was considered to be abnormal (Table 1). Patients were prospectively identified and consented on the morning of their procedure.

Once consented, the patient was randomized to either the standard group where vital signs were monitored every 4 hours, including overnight; or to the intervention group where vital signs were not checked between 10pm and 5am. For both groups, nurses continued to round every two hours at the patient’s bedside, but not waking or disturbing the patient if they were sleeping. Vital signs were taken at any time and for any reason at the nurse’s clinical discretion. The planned procedure needed to be completed by 5pm for the patient to remain in the study. All patient charts were reviewed to assess for prolonged hospital stay and escalation of care.

**Questionnaire**

Participants in the study were provided a questionnaire, validated by Freedman et al, on the day following their overnight stay to assess their perception of quality of sleep and satisfaction with their hospital stay (*complete survey here: <http://pxjournal.org/cgi/viewcontent.cgi?filename=5&article=1185&context=journal&type=additional>*)<sup>4</sup>. Quality of sleep questions were based on a 10 point-scale (1= poor to 10=excellent). Sleep disruption was also measured on a 10 point scale (1=no disruption to 10 being the most disruptive). Patients also rated the degree of disruption from activities and noises on the same 10 point scale. For these questions, a value of N/A for any question was re-classified as a value of one, not disruptive. Finally, participants rated their overall degree of daytime sleepiness during their hospital stay on a 10 point scale (1=poor to 10=excellent). Because of the distribution of the responses, we re-categorized each question into three groups by score. For quality of sleep, poor (1-3), moderate (4-6), and good/excellent (7-10) and for the disruption questions low (1-3), moderate (4-6) and high (7-10). We also re-categorized in this manner to apply a more qualitative assessment to the data.

**Analysis**

To take into account how quality of sleep at home may affect sleep in the hospital, we calculated a composite score by subtracting the quality of sleep in the hospital from response to quality of sleep at home. A value less than 0 indicates a better sleep score in the hospital than at home.

Continuous demographic variables and lab values were compared between groups using a two-sample t-test or a Wilcoxon Rank Sum Test. The categorical demographic characteristics and questionnaire responses were compared between groups using a Chi-square or Fisher’s Exact test. Any questions that were not answered (at most 2 per question in either group) were removed for analysis to ensure the calculated percentages reflected the answered questions. Given the small sample size and inherent difficulty detecting a statistical difference between qualitatively different scores, we chose to present significance levels below  $p < 0.10$  as significant. All statistical analyses were performed using Stata 13 (Statacorp LP, College Station, TX) or SAS 9.3 (SAS Institute Inc., Cary, NC).

**Table 1. Range of pre-procedural vital signs criteria that qualify for exclusion from this study**

Heart rate greater than 100 or less than 45 beats per minute at rest
Systolic blood pressure greater than 160, or less than 100 mmHg
Respiratory rate less than 8 or greater than 30 breaths per minute
Pulse oximetry less than 88% on room air

**Table 2. Demographic data**

	Standard (39)	Intervention (41)	p-value
Age	63.9 ± 11.7	61 ± 12.3	0.277
BMI	32.7 ± 7.5	30.8 ± 6.9	0.245
EF (%)	51.6 ± 11.8	53.2 ± 12.7	0.575
Gender (male)	32 (82.1%)	27 (68.9%)	0.100
DM	12 (30.8%)	17 (41.5%)	0.320
HTN	35 (89.7%)	31 (75.6%)	0.142
Prior CVA	5 (12.8%)	6 (14.6%)	0.999
Prior PCI	16 (42.1%)	14 (34.2%)	0.466
Procedure:			0.894
PCI	26 (66.7%)	25 (61%)	
AF ablation	9 (23.1%)	10 (24.4%)	
PPM/ICD	4 (10.3%)	6 (14.6%)	
Lab:			
pre_hgb	13.3 ± 1.5	13.3 ± 1.5	0.964
pre_plts	227.5 ± 54.7	222.4 ± 67.3	0.715
pre_inr	1.3 ± 0.6	1.3 ± 0.5	0.954
pre_cr	1.1 ± 0.4	1.1 ± 0.4	0.927
post_hgb	12.5 ± 1.5	12.3 ± 1.6	0.476
post_plts	207.6 ± 42.4	199.6 ± 62.1	0.504
post_inr	2.2 ± 0.8	2.1 ± 0.7	n/a
post_cr	1.1 ± 0.4	1.1 ± 0.3	0.608

Demographic data of the Standard and Intervention groups (EF: ejection fraction; DM: diabetes mellitus; HTN: hypertension; CVA: cerebral vascular accident; PCI: percutaneous coronary intervention; AF: atrial fibrillation; PPM: permanent pacemaker placement; ICD: implantable cardioverter-defibrillator; pre: pre-procedure; hgb: hemoglobin; plts: platelets; INR: international normalized ratio; cr: creatinine; post: post-procedure). n/a indicates no comparison was made due to the large proportion of missing values for post\_inr.

**Results**

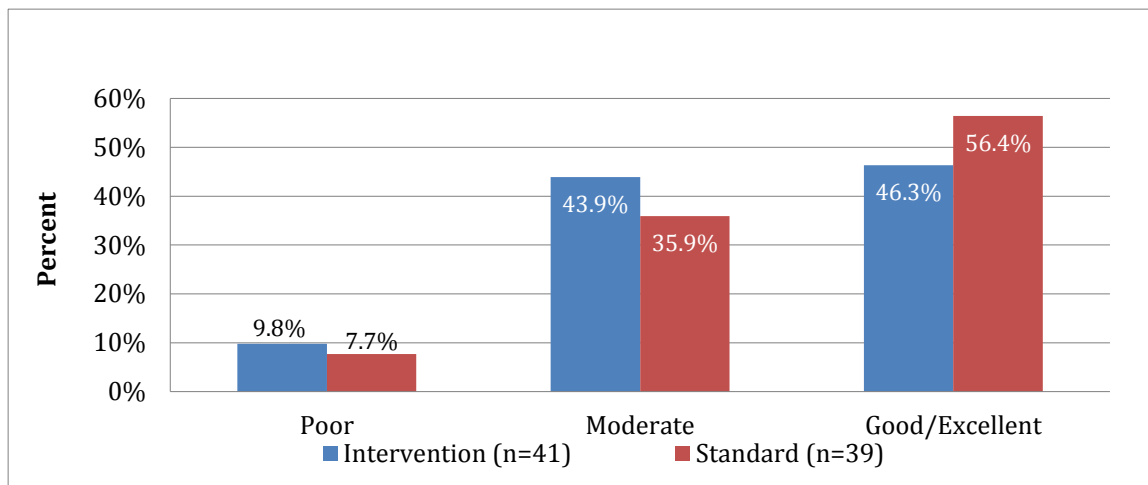
During the study period, 39 patients were enrolled in the standard group and 41 in the intervention group. All enrolled patients remained in the study to completion. Demographic and pre and post procedural lab values were not statistically significant different between the groups (Table 2). All patients were discharged post-procedural day 1 as planned, and no patient safety adverse events were recorded for patients in either group. Seven of the 39 patients in the intervention group had vital signs obtained between 10 pm and 5 am. One patient had vital signs checked after 10pm due to a pulled arterial sheath that required vital sign monitoring as part of routine care and the other 6 had vital signs checked per nursing concerns (the patients requested pain medication and the nurse checked their vital signs before administering the

medicine). These patients were analyzed in the intervention group per an intention-to-treat model.

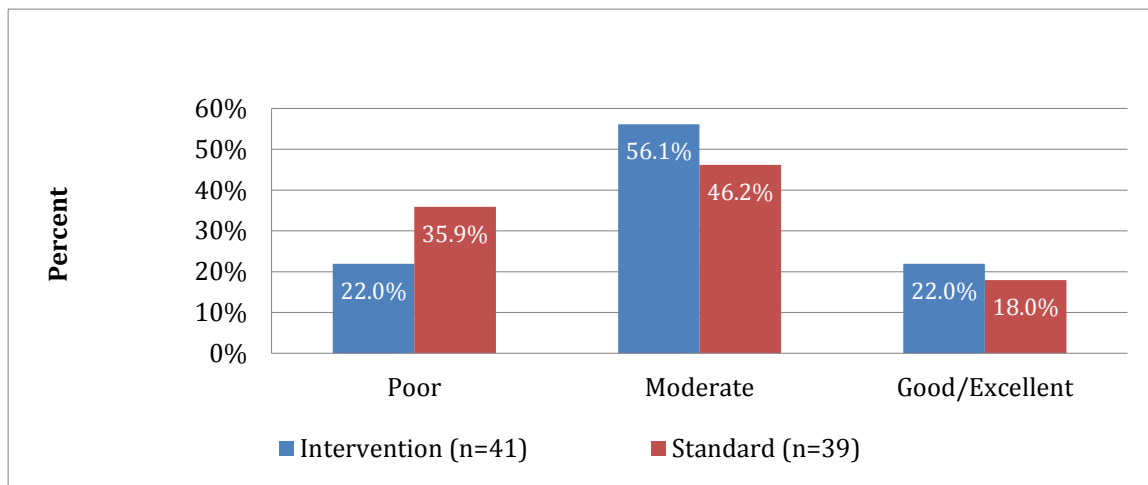
A higher proportion of patients in the standard group stated their sleep was good/excellent at home compared to the intervention group, but there was no significant difference in the overall response between the two groups, (p = 0.71, Figure 1). Although more patients in the intervention group stated they had moderate or good/excellent sleep in the hospital, the overall responses of the quality of sleep in the hospital were not significantly different between the intervention and standard groups (p = 0.42, Figure 2).

Using the composite scores of sleep quality in the hospital versus at home, 25.6% of patients in the standard group had the same or better sleep in the hospital than home compared to 34.1% in the intervention group. Nine

**Figure 1. Rating of overall quality of sleep at home by intervention and standard groups**



**Figure 2. Rating of overall quality of sleep in the hospital by intervention and standard groups**



patients (23.1%) in the standard and none in the intervention group had a difference greater than 5 indicating a larger discrepancy in the quality of sleep at hospital compared to the home for this group (Figure 3). There was a trend to less disruptive sleep between home and hospital sleep for the intervention group, with a moderate significance at  $p = 0.096$ .

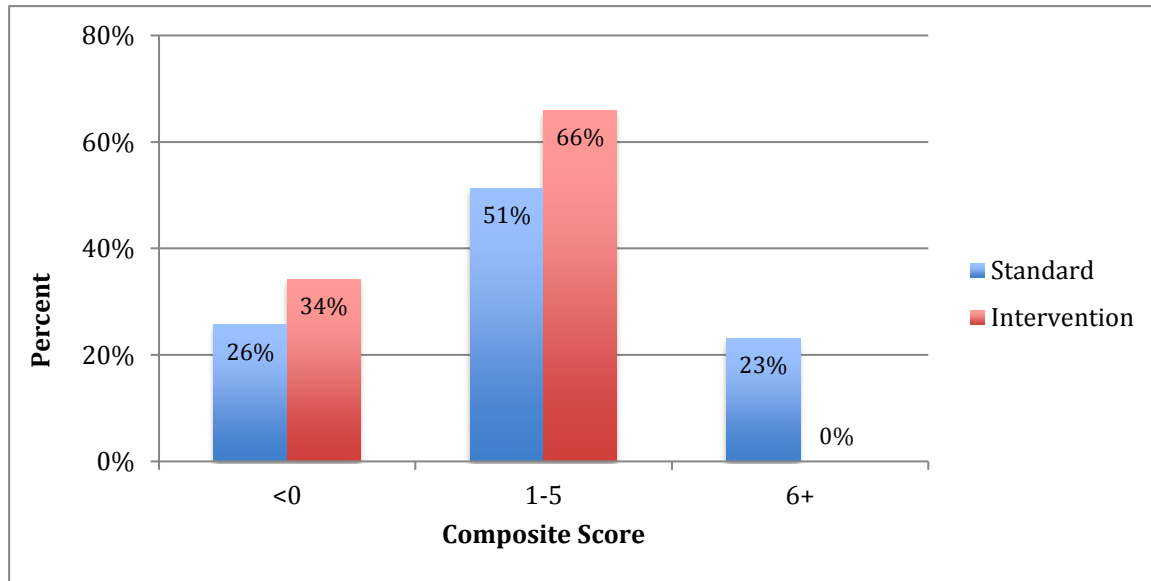
In comparing the responses to the questions regarding the degree of disruption from activities and noises, there were no statistically significant differences in responses between the intervention and standard groups, except blood draws were more disruptive to the standard group ( $p = 0.006$ ). There was no difference found in the overall satisfaction of hospital stay response between the intervention and standard groups ( $p = 0.999$ , Figure 4).

### Discussion

Obtaining appropriate vital signs is important in providing adequate care for all hospitalized patients. The frequency at which vital signs are obtained, however, is often not inherently based in evidence and often occurs at the same interval regardless of the patients risk for clinical deterioration.<sup>1</sup>

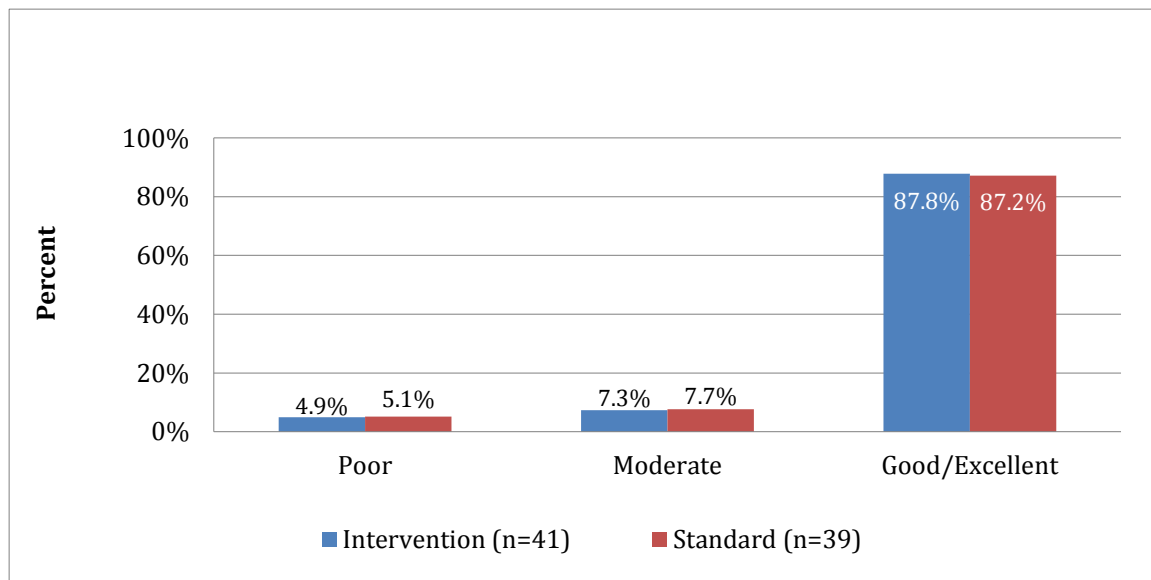
To the best of our knowledge, we present the first prospective randomized trial to assess the impact of reduced overnight vital sign monitoring on patients' perception of sleep quality in a low-risk population. From a patient safety standpoint, it is important to note that all the patients in this study were successfully discharged the day following the prescribed procedure and did not

**Figure 3. Composite score distribution of sleep rating at home and hospital by group.**



A score <0 indicates higher sleep in the hospital as compared to home, and score >0 indicates higher score at home then hospital (composite score = [rating of sleep at home] – [rating of sleep in hospital])

**Figure 4. Rating of overall satisfaction with hospital stay by intervention and standard groups**



experience any adverse events overnight. A key aspect of the design of our study was nurses were instructed to observe all patients, regardless of randomization, every 2 hours. This is vital because although nurses were not recording vital signs, the practice provided reassurance to the patients that they not clinically abandoned during the night hours.

This argues against the utility of obtaining routine vital signs overnight in low-risk patients as opposed to allowing the nurse to use clinical judgment as to when to obtain overnight vital signs. In this setting, obtaining nighttime vital signs in low-risk patients provide little value without a clinical assessment being performed at the time they were obtained.

Although only a moderate statistical significant was found between the two groups in the quality of sleep in the hospital versus home, a higher proportion of moderate and good/excellent responses were seen in the intervention group compared to the standard group across sleep quality questions. It is also important to recognize a higher proportion of patients in the intervention group rated their quality of sleep the same or better in the hospital compared to the standard group. Moreover, there were nine patients in the standard group and none in the intervention group that reported a high discrepancy between the quality of sleep in the hospital compared to home. Since the patients in our study only stayed one night in the hospital, it may have been difficult to detect a significant difference in quality of sleep between our study groups. As seen in a previous study<sup>2</sup>, applying this concept to patients who stay multiple nights in the hospital may allow for better understanding of how routine nighttime vital signs affect quality of sleep.

We did not find a statistically significant difference between our groups on reporting of satisfaction with hospital stay. Similarly, a previous descriptive study on this topic did not find an association between the rate of nighttime disturbance and patient satisfaction<sup>11</sup>. These findings may not be unexpected as satisfaction with hospital stay is impacted by various factors, such as patient demographic and health status factors<sup>12</sup>, health outcomes<sup>12</sup>, perceptions of the quality of interactions with the care team<sup>13</sup>, and perceived understanding of medical events that occurred during the hospitalization<sup>14</sup>. It may have also been difficult to expect a greater impact on our intervention as our patients only stayed one night in the hospital. For this reason, gauging the patient satisfaction effect of a modified vital sign project may be best suited for patients who stay multiple nights in the hospital.

At our institution, we are very invested in providing safe care and monitoring patients appropriately. Before initiating this current study, we invested tremendous time and energy in to appropriate monitoring of patients across the institution. Our initiatives have led to success in decreasing inappropriate cardiac monitoring, decrease emergency room boarding times, and decreasing the percentage of false alarms.<sup>5-6</sup> Most importantly, neither the length of stay nor mortality changed significantly after these policies were implemented. These successes enabled the success of this study.

### Limitations

Our study was conducted at a single institution and the results may not be generalizable to a larger patient population. We initially planned to enroll 69 patients in each group, but had to stop enrollment due to the initiation of a policy to send our eligible patients home the same day after their procedure. We also had a non-

significant number of patients who were interrupted overnight in the intervention group due to nurse concerns about their medical state. These patients, 18% of the intervention sample, were analyzed under the intention to treat model. These issues certainly hindered our ability to detect a significant difference between our groups at the traditional  $p < 0.05$ . However we did find significant results at  $p < 0.10$  level, and we established that reduced vital sign monitoring is a safe option for low risk patients.

### Conclusion

The standard of care at our institution was routine vital sign monitoring at least every 4 hours, regardless of patient status or risk level. This study has established that in a group of low-risk patients hospitalized for minor cardiac procedures, not obtaining vitals between 10pm and 5am does not threaten patient safety and may led to improved patient perceptions of sleep quality, particularly when the patient compares hospital sleep to sleep at home. For all patients, nurses rounded every two hours at the patient's bedside, resulting in 18% of the intervention group receiving vital monitoring because of nursing concerns. Thus this initiative truly leveraged the idea of appropriate vitals for the appropriate patients at the appropriate intervals. With this proof of concept now safely implemented, it is our intention to initiate further studies to broaden our inclusion criteria and population to encourage a restful and healing environment through the entire healthcare stay.

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### References

1. Yoder JC, Yuen TC, Churpek MM, Arora VM, Edelson DP. A prospective study of nighttime vital sign monitoring frequency and risk of clinical deterioration. *JAMA internal medicine*. 2013;173(16):1554-1555.
2. Storm-Versloot MN, Verweij L, Lucas C, et al. Clinical relevance of routinely measured vital signs in hospitalized patients: a systematic review. *Journal of nursing scholarship : an official publication of Sigma Theta*



- Tau International Honor Society of Nursing / Sigma Theta Tau*. 2014;46(1):39-49.
3. Bihari S, Doug McEvoy R, Matheson E, Kim S, Woodman RJ, Bersten AD. Factors affecting sleep quality of patients in intensive care unit. *Journal of clinical sleep medicine : JCSM : official publication of the American Academy of Sleep Medicine*. 2012;8(3):301-307.
  4. Freedman NS, Kotzer N, Schwab RJ. Patient perception of sleep quality and etiology of sleep disruption in the intensive care unit. *American journal of respiratory and critical care medicine*. 1999;159(4 Pt 1):1155-1162.
  5. Thomas KP, Salas RE, Gamaldo C, et al. Sleep rounds: a multidisciplinary approach to optimize sleep quality and satisfaction in hospitalized patients. *Journal of hospital medicine*. 2012;7(6):508-512.
  6. Delaney LJ, Van Haren F, Lopez V. Sleeping on a problem: the impact of sleep disturbance on intensive care patients - a clinical review. *Annals of intensive care*. 2015;5:3.
  7. Young JS, Bourgeois JA, Hilty DM, Hardin KA. Sleep in hospitalized medical patients, part 1: factors affecting sleep. *Journal of hospital medicine*. 2008;3(6):473-482.
  8. Miner SE, Pahal D, Nichols L, Darwood A, Nield LE, Wulffhart Z. Sleep Disruption is Associated with Increased Ventricular Ectopy and Cardiac Arrest in Hospitalized Adults. *Sleep*. 2016;39(4):927-935.
  9. Sharda S, Carter J, Wingard JR, Mehta P. Monitoring vital signs in a bone marrow transplant unit: are they needed in the middle of the night? *Bone marrow transplantation*. 2001;27(11):1197-1200.
  10. Pellicane AJ. Relationship between nighttime vital sign assessments and acute care transfers in the rehabilitation inpatient. *Rehabilitation nursing : the official journal of the Association of Rehabilitation Nurses*. 2014;39(6):305-310.
  11. Ugras GA, Babayigit S, Tosun K, Aksoy G, Turan Y. The effect of nocturnal patient care interventions on patient sleep and satisfaction with nursing care in neurosurgery intensive care unit. *The Journal of neuroscience nursing : journal of the American Association of Neuroscience Nurses*. 2015;47(2):104-112.
  12. Iannuzzi JC, Kahn SA, Zhang L, Gestring ML, Noyes K, Monson JR. Getting satisfaction: drivers of surgical Hospital Consumer Assessment of Health care Providers and Systems survey scores. *The Journal of surgical research*. 2015;197(1):155-161.
  13. Kahn SA, Iannuzzi JC, Stassen NA, Bankey PE, Gestring M. Measuring satisfaction: factors that drive hospital consumer assessment of healthcare providers and systems survey responses in a trauma and acute care surgery population. *The American surgeon*. 2015;81(5):537-543.
  14. Kebede S, Shihab HM, Berger ZD, Shah NG, Yeh HC, Brotman DJ. Patients' understanding of their hospitalizations and association with satisfaction. *JAMA internal medicine*. 2014;174(10):1698-1700.