Original Article

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A national point-prevalence survey of the practice of sedation, analgesia, neuromuscular blockade and delirium assessment in adult intensive care units in Singapore

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Abstract

***Introduction*: The aim of this survey is to establish current practices of sedation, analgesia, neuromuscular-blockade use and delirium assessment in adult ICUs in Singapore.**

***Methods*: All adult ICUs from the government-restructured hospitals were invited to participate in a point-prevalence survey on the 30th October 2008, under the direction of the Society of Intensive Care Medicine's National Investigators for Clinical Epidemiology and Research. Data collected for all adult ICU inpatients included demographics, practices on sedation, analgesia and neuromuscular blockade as well as delirium assessment and management.**

***Results*: There were 93 patients from 11 ICUs. The mean age was 61.2 years with a predominance of Chinese (76.3%) and a slight male predominance of 57.0%. Sedation was administered in 25.8% of the patients with the use of sedation scales in 75.0%. Only 20.8% of the sedated patients were on a sedation protocol. The majority of patients had daily interruption of sedation. Analgesia assessment was done in most patients (78.5%) with the use of analgesia scales. Analgesia was used in approximately one third of patients. Only 2 patients were on neuromuscular blockade. There was no usage of any formal delirium assessment tools at all with almost one third of patients being physically restrained.**

***Conclusions*: This national multi-centre study reveals several deficits in the adult ICU with regards to sedation and delirium assessment and management. Several initiatives should be implemented to improve patients' safety and quality of care in the ICU.**

Introduction

Critically ill patients, especially those on mechanical ventilation, often receive sedation and analgesia to minimize pain, alleviate anxiety and facilitate nursing care. Stressors encountered by patients include pain, sleep deprivation and the presence of tubes in the nose and mouth. Under-sedation may result in pain, anxiety and ventilator dyssynchrony whereas over-sedation could result in adverse effects including prolonged duration of mechanical ventilation and intensive care unit (ICU) duration of stay. (1,2) The use of scoring systems (3,4) with goal-orientated sedation and analgesia has been recommended by clinical practice guidelines (5) to provide optimal patient comfort in the ICU setting whilst minimizing the adverse effects of sedatives and analgesics.

Delirium assessment and management is crucial in the ICU

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as delirium results in multiple complications and adverse outcomes including increased health care costs, prolonged hospital stay and increased mortality. (6-8)

Neuromuscular blockade (NMB) use in the ICU may facilitate certain modes of ventilation or management of patients with head trauma and tetanus. However its use could result in various syndromes characterized by skeletal muscle weakness in the critically ill patient, thus limiting its use. (9)

There often exists a substantial gap between recommended guidelines and clinical practice, (10) emphasizing the need to document what is done daily in the ICU to facilitate future national guidelines. (11) The aim of the present survey is to establish the current practice of sedation, analgesia, neuromuscular blockade use and delirium assessment and management in adult ICUs in Singapore. Identifying deficiencies in these areas will allow intensivists to improve on patient care and safety with the ultimate goal of improving outcomes. In addition, we also wanted to know if there were significant differences in practices between medical and surgical ICUs.

Materials and methods

Study design

The point-prevalence survey was conducted through the Society of Intensive Care Medicine's National Investigators for Clinical Epidemiology and Research (SICM-NICER). The local ethics committee, Singhealth Institutional Review Board (IRB), approved the design of the study and considering its observational nature, waived requirements for informed consent from the patients (IRB Reference no. 290/2008). All adult ICUs from the five government hospitals were invited to participate. All patients present at the ICU or who were admitted during the 24 hour study period –between 08.00 on 30th October 2008 and 08.00 on 31st October 2008 were included in the study. A case report form (CRF) was completed for every patient in the ICU by the managing ICU doctors. The data were collected at 2 time points, the first on the 30th October 2008 at 08.00 for all existing ICU patients and the second on the 31st October 2008 08.00 for patients who were admitted during the 24 hour study period.

Case report form

Data were collected in 5 categories encompassing patient-level information, practices about sedation, analgesia, neuromuscular blockade and delirium assessment. Patient-level information included demographics, admission specialty, principal diagnosis, severity scores, hospital and ICU length of stay. The type of respiratory support, surgical sites, number of drains and devices were also recorded.

Participation

We recruited 11 adult ICUs (5 medical, 6 surgical ICUs). These ICUs are managed primarily by respiratory medicine or anesthesiologist-trained intensivists, following a closed-ICU concept. In Singapore, we have a total of 5 restructured government hospitals comprising of 15 adult ICUs of which 11 participated. One burns ICU, one cardiothoracic and two neurosurgical ICUs had declined to be included in this study. The 5 restructured government hospitals provide 80% of the inpatient care with the private hospitals providing the remainder 20%. (12)

Statistics

Data are expressed as mean (SD), median (interquartile range [IQR]) or proportions as appropriate. Continuous variables were compared with Student t test or Mann-Whitney U test if the distribution was nonparametric. Proportions were compared using chi-square test or Fisher Exact test. In the presentation of results, statistical significance was set at $p<0.05$ (two-tailed). Analyses were performed using the SPSS© version 11.0.1 software package (SPSS Inc., Chicago, IL, USA).

Results

Baseline data

Data from 93 patients were collected for this study, with 53 patients from the medical ICUs and 40 from the surgical ICUs. There was an overall predominance of males (57%) with a mean age of 61.2 years old. Chinese, Malays and Indians represented 76.3%, 17.2% and 4.3% respectively of our cohort, consistent with our population's ethnic distribution. Approximately a quarter of the patients had no severity scoring done yet at the time of the study. The mean APACHE II score was 21.4. At the point of the survey, the

median length of ICU stay was 4 (IQR 2-9) days and that in the hospital was 8 (IQR 2-13) days (**Table 1**). Comparison of baseline characteristics between the medical and surgical cohorts was similar except for a male predominance and a higher mean APACHE II score for the medical patients.

Forty three (46.2%) of the patients were mechanically ventilated (MV) of which 13 were ventilated via tracheostomy. The mean number of devices per patient was 4 (**Table 2**). Surgical patients had more invasive devices present with more of them having intra-arterial monitoring line. The surgical cohort had significantly more drains and surgical wounds present.

Sedation practices

Of the 93 patients, only 24 (25.8%) of them were sedated with the majority of patients having sedation omitted for reasons such as hypotension, low Glasgow Coma Scale score or deemed unnecessary by the managing team during ward rounds (**Table 3**). Amongst the mechanically ventilated patients, more than half were not given any sedation due to reasons cited as above (**Table 3a**).

The majority of the patients (75%) who were sedated were monitored, with either Ramsay or Riker sedation scales. A quarter of them were based on assessment by the managing team with no use of validated scales. Titration of the sedation was decided by the doctors with only 20.8% being protocol driven. A relatively small number (12.5%) of the sedated patients were not monitored whilst on sedation. One third of patients who were monitored with sedation scales had no target sedation level. Moreover different ICUs had different sedation targets. Patients in surgical ICUs tend to be monitored more frequently compared to those in the medical ICUs.

The majority (84.2%) of the mechanically ventilated patients who were sedated was monitored with sedation scales and almost one third of them were on a sedation protocol. Most of the patients were monitored hourly (**Table 3a**).

The most commonly used sedatives included continuous infusion of midazolam or propofol. None of the patients on propofol infusion had interval serum triglyceride levels checked. None of the patients were on dexmedetomidine. Most patients (70.8%) had daily interruption of sedation.

Analgesia practices

Analgesia assessment was done in the majority of patients (78.5%). Assessment was deemed as done if analgesia scales were used to assess presence and degree of pain, or done "informally" by the managing team. "Informal" assessment included direct questioning of awake patients for pain without the use of pain scales as well as subjective observation that patients were in pain. Our study found that analgesic medications were employed in approximately one third (35.5%) of patients with the majority monitored using analgesic scales. These include a numerical rating scale, a visual analogue scale, the Wong-Baker Faces Pain Rating scale and the modified FLACC (Face, Leg, Activity, Cry, Consolability) scale. The proportion of patients receiving oral analgesia, such as paracetamol and tramadol, was comparable to those receiving intravenous analgesics, such as morphine and fentanyl (**Table 4**). All 4 medical patients were administered with intravenous continuous morphine infusion. Eight surgical patients received intravenous morphine, of which only one was intermittent and the rest on continuous infusion. Five of the surgical patients received intravenous fentanyl of which only one was intermittent and the rest on continuous.

There was no difference in analgesia use and monitoring between mechanically and non-mechanically ventilated critically ill patients. As expected, mechanically ventilated patients received more intravenous opioids, with the majority of them on intravenous continuous morphine or intravenous continuous fentanyl (**Table 4a**).

More surgical patients received analgesia compared to medical patients with more use of intravenous opioids in surgical patients. These differences were also noted in mechanically ventilated patients between medical and surgical patients. There were, however, no differences in assessment for pain or the use of analgesia scales.

Delirium assessment and management

The majority of patients were not assessed for delirium (**Table 5**). Those who were assessed were based on clinical judgment rather than the use of delirium scale assessment tools. Use of physical restraints was employed in almost one third (29.0%) of the patients and sleep promotion was seldom employed. There was no use of medications such as haloperidol or the atypical antipsychotics for any patients.

Neuromuscular blockade practices

There were only 2 patients (2.2%) who were on continuous intravenous neuromuscular blockade (atracurium).

Discussion

This national point prevalence survey is the first multi-center study involving adult ICUs in Singapore to document sedation, analgesia, neuromuscular blockade and delirium management practices. There have been several recent surveys done in various countries from Europe, Canada and the United States of America with almost no data from Asian countries. (13-16) We believe this is the first study in Asia to provide a snapshot of current actual practices in sedation, analgesia, neuromuscular blockade and delirium in critically ill patients.

The major findings of this survey include the low proportion of usage of sedation protocols, the severe lack of delirium assessment coupled with a significant use of physical restraints. These findings are crucial and warrant a change in the way sedation and delirium assessment and management is implemented in adult ICUs in Singapore. There were no major differences in practices between medical and surgical ICUs.

About a quarter of patients were treated with sedatives. This is much lower compared to previous surveys where usage ranges from 60-90%. (14,17) Although these surveys included largely mechanically ventilated patients, less than 50% of mechanically ventilated patients in this survey were sedated. The reasons often cited were hypotension, low GCS and clinically assessed as comfortable and unnecessary. In more than one third of patients, sedation was withheld as the physicians had deemed these patients as comfortable clinically during ward rounds. About 42.2% of mechanically ventilated patients were not sedated as patients were assessed as comfortable. The lower proportion of patients on sedation suggests that perhaps we may be under-sedating our patients. On the other hand, patients who were sedated were monitored with sedation scales but the sedation target varied widely amongst different ICUs, with up to one third having no target at all, emphasizing the need for better sedation management. This variation in optimal sedation targets are also seen in other studies. (18) The titration of sedation is mainly done by doctors with a small percentage (20.8%) being protocol driven. A recent study had shown that a nurse-implemented sedation protocol had resulted in improved outcomes with faster resolution of critical illness and shorter ICU and hospital stay. (19) Similar to other studies, the Ramsay scale was the most commonly used scale. (20,21) Although data was not collected on the degree of sedation the patients were in, it is believed that most of the patients sedated are usually over sedated as this often is mistakenly believed to facilitate procedures, nursing care and prevent accidental extubation. (18) Having sedation protocols in these ICUs with the use of sedation scales might be useful, given the increasing evidence supporting the use of protocolized care with structured approaches that prioritize avoiding the accumulation of drugs and metabolites that could lead to slower recovery. (3,4,22,23) Most of our patients were sedated with either continuous infusion of midazolam or propofol, similar to practices elsewhere. (15,24,25) There was no recorded use of dexmedetomidine during this point-prevalence survey, suggesting that this novel sedative is not widely used here. Dexmedetomidine may result in a lower incidence of delirium and a shorter duration of mechanical ventilation. (26) In contrast to previous studies, (21,24,25) the majority of our sedated patients had daily interruption of sedation for weaning assessment, a strategy that has been shown to reduce duration of MV and ICU length of stay. (1) In addition, the Awakening and Breathing Controlled Trial had shown that pairing of daily spontaneous awakening trials (ie interruption of sedatives) with daily spontaneous breathing trials resulted in improve outcomes in mechanically ventilated critically ill patients. (27) There were no significant differences in sedation use and sedation assessment scale usage between medical and surgical patients. However, patients in surgical ICUs tend to be monitored more frequently compared to medical ICUs patients, with a preference for the use of propofol as the sedating agent of choice.

Analgesia assessment was done in the majority of our patients with most being monitored with analgesia scales rather than informal assessment. Analgesia was administered in about one third, with similar findings in the mechanically ventilated group. This contrasts with the French study by Payen et al, (20) who showed that the majority of patients were given opioids but less than half were assessed for pain. It may be postulated that since the majority of the patients

were monitored for pain, there were fewer number of patients who received analgesia; confirming that analgesia would be more widely and unnecessarily used if patients were not assessed. Although surgical patients were more likely to receive analgesia, the surgical patients were found to have more drains, surgical wounds and number of invasive devices compared to medical patients.

Neuromuscular blockade is seldom employed in our survey, concurring with practices elsewhere. (15,28,29) The usage of NMB is less studied than the use of sedation and analgesia. Small, single-institution, prospective studies have generally reported NMB usage to be low, ranging from 3.4% to 15.5%. (30-32) While NMB may be useful in facilitating mechanical ventilation, the side effects of critical care-associated paresis and prolonged ventilation days have curbed its use. (9)

Delirium has been reported to occur in about 35% to 80% of critically ill patients. (17,33,34) The variability in rates depends partly on severity of illness and the type of instrument used. The majority of our patients were not monitored for delirium and there was no use of any delirium assessment tools. Slightly more than a quarter of patients were assessed clinically which is considered inadequate, (17,33,34) with the majority of patients being undiagnosed and thus at risk of being sub-optimally managed. Moreover, hypoactive delirium tends to be missed without the use of a delirium assessment tool. (35,36) Alarmingly, almost one third of patients were physically restrained and none were treated with any pharmacologic agents for presumptive delirium. There are several delirium assessment tools that have been well validated and convenient to administer. These include the Confusion Assessment Method-Intensive Care Unit (CAM-ICU) Assessment Tool, (36) the Intensive Care Delirium Screening Checklist (37)and Delirium Screening Checklist (38) which should be considered for implementation in all our ICUs. This lack of delirium assessment is also seen in other surveys (13,39) even though routine screening for delirium is recommended. (5) Indeed, physicians are often aware that delirium is under-diagnosed and represents a significant risk factor for sub-optimal outcomes. However, a recent survey by Patel et al (16) had revealed that this knowledge does not translate into effective clinical practice, emphasizing the large disconnect between intellectual awareness of the adverse consequences of delirium and absence of clinical action. Hence education and, more importantly, implementation of delirium assessment and management in our ICUs is crucial. Although it has been shown that delirium is an independent predictor of higher mortality, length of stay, higher cost and reduced quality of life, little is known of non-pharmacologic and pharmacologic delirium prevention and treatment in the critical care setting.

There are several limitations in our survey. Firstly, the inherent design of the survey and a 24-hour study period may not be entirely reflective of actual day-to-day practices. Secondly, the number of patients in this survey is small compared to other national surveys, but this reflects the ICU daily patient load in Singapore. Thirdly, these findings cannot be generalized to open-type ICUs such as those in the private sector in Singapore. In Singapore, we have a total of 5 government-restructured hospitals comprising of 15 adult ICUs of which 11 ICUs participated. This survey did not include the burns ICU, two neurosurgical ICUs and one cardiothoracic ICU. The 5 restructured government hospitals provide 80% of the inpatient care with the private hospitals providing the remainder 20%. (12) Hence, although private institutions were not included, this study would reflect the medical care received by the majority of patients in Singapore. Nevertheless, this survey offers a snapshot and a reflection of actual practices of sedative, analgesia, NMB and delirium assessment and management in Singapore adult ICUs.

This study has highlighted several deficits in our practice. We suggest that sedation protocols be used more frequently with adoption of strategies to optimize analgesia and sedation practices to improve patients' outcomes. (40) Also, there is an urgent need to better our delirium management practices with regards to education and more importantly incorporating this knowledge into our daily practices.

Conclusion

Our survey reveals that sedation and analgesia is used less in the adult ICUs compared to practices elsewhere with the majority of patients monitored with analgesia scales. Protocol-based sedation and analgesia were not frequently employed. There is a disturbingly significant proportion of patients on physical restraints without appropriate assessment

and management of delirium. The use of neuromuscular blockade is infrequent. There were no significant differences in practices of sedative and analgesia use between medical and surgical ICUs. This study highlights the need for the drafting and implementation of national guidelines to improve these practices.

Table 1. Demographics and baseline characteristics

Characteristics	Medical (n=53)	Surgical (n=40)	Total (n=93)	p value
Gender, n (%)				
Male	36 (67.9)	17 (42.5)	53 (57)	0.028
Mean age, years (SD)	61.0 (18.14)	61.4 (15.13)	61.2 (16.83)	1.000
Race, n (%)				
Chinese	36 (67.9)	34 (85)	71 (76.3)	0.101
Malays	12 (22.6)	4 (10)	16 (17.2)	0.215
Indians	4 (7.5)	0	4 (4.3)	N.A.
Others	1 (1.9)	2 (5.0)	2 (2.2)	0.827
ICU severity scoring[a]				
Available APACHE II score, n (%)	27 (50.9)	33 (82.5)	60 (64.5)	N.A.
Mean APACHE II score (SD)	24.3 (10.21)	19.1 (8.82)	21.4 (9.74)	0.012
No scoring done, n (%)	17 (32.7)	7 (17.5)	24 (25.8)	0.162
Principal diagnosis, n (%)				
Central nervous	3 (5.7)	17 (42.5)	20 (21.5)	0.001
Cardiovascular	17 (32.1)	4 (10)	21 (22.6)	0.024
Respiratory	22 (41.5)	2 (5.0)	23 (24.7)	0.001
Gastrointestinal	5 (9.4)	12 (30.0)	17 (18.3)	0.023
Genitourinary	2 (3.8)	0	2 (2.2)	N.A.
Dermatology	2 (3.8)	1 (2.5)	3 (3.2)	0.081
Others	2 (3.8)	5 (12.5)	7 (7.5)	0.205
Median length of stay, days (IQR)				
ICU	2 (1-7)	8 (2-10)	4 (2-9)	0.586
Hospital	5 (1-12)	10 (4-14)	8 (2-13)	0.363

Legend: [a]=9 medical patients (9.7%) had SAPS II score done with a mean score of 31.7; N.A.=non applicable

Table 2. Respiratory support, devices and wounds

	Medical (n=53)	Surgical (n=40)	Total (n=93)	p value
Respiratory support, n (%)				
Mechanical ventilation	20 (37.7)	23 (57.5)	43 (46.2)	0.088
Non invasive ventilation	8 (15.1)	0	8 (8.6)	0.009
Not ventilated	25 (47.2)	17 (42.5)	42 (45.2)	0.863
Tracheostomy, n (%)	4 (7.5)	9 (22.5)	13 (14.0)	0.078
Devices, n (%)				
Mean, n (SD)	3.4 (1.4)	4.8 (1.37)	4 (1.55)	0.001
Central venous line	20 (37.7)	24 (60.0)	44 (47.3)	0.058
Intra-arterial line	36 (67.9)	36 (90.0)	72 (77.4)	0.024
Dialysis catheter	9 (17.0)	8 (20.0)	17 (18.3)	0.920
Intravenous canula	34 (64.2)	26 (65)	60 (64.5)	0.905
IABP[a]	0	1 (2.5)	1 (1.1)	0.430
ICP[b] monitor	0	3 (7.5)	3 (3.2)	0.076
Nasogastric tube	33 (62.3)	35 (87.5)	68 (73.1)	0.01
Urinary catheter	42 (79.2)	35 (87.5)	77 (82.8)	0.462
Drains, n (%)	5 (9.4)	21 (52.5)	26 (28.0)	0.001
Surgical wound(s), n (%)	3 (5.7)	32 (80)	35 (37.6)	0.001

Legend: [a]=Intra-aortic balloon pump; [b]=Intracranial pressure

Table 3. Sedation practices

	Medical (n=53)	Surgical (n=40)	Total (n=93)	p value
Sedation use, n (%)				
Administered	14 (26.4)	10 (25.0)	24 (25.8)	0.897
Not given with reason	31 (58.5)	27 (67.5)	58 (62.4)	0.502
Not considered	8 (15.1)	3 (7.5)	11 (11.8)	0.477
	Medical (n=14)	Surgical (n=10)	Total (n=24)	
Use of sedation scales[a], n (%)	10 (71.4)	8 (80.0)	18 (75.0)	
Sedation titration, n (%)				
Doctor's decision	7 (50.0)	5 (50.0)	12 (50.0)	
Nurse's decision	5 (35.7)	2 (20.0)	7 (29.2)	
Protocol driven	2 (14.3)	3 (30.0)	5 (20.8)	
Monitoring frequency, n (%)				
Not monitored	3 (21.4)	0	3 (12.5)	
Hourly	5 (35.7)	9 (90.0)	14 (58.3)	
4 hourly	4 (28.6)	1 (10.0)	5 (20.8)	
8 hourly	2 (14.3)	0	2 (8.3)	
Sedative drug, n (%)				
Propofol (IV continuous)	4 (28.6)	8 (80.0)	12 (50.0)	
Midazolam (IV continuous)	8 (57.1)	2 (20.0)	10 (41.7)	
Lorazepam (oral)	2 (14.3)	0	2 (8.3)	
Daily interruption, n (%)				
Done	12 (85.7)	5 (50.0)	17 (70.8)	

Legend: [a]=13 (54.2%) used Ramsay sedation scale, 5 (20.8%) used Riker scale

Table 3a. Sedation practices between mechanically and non-mechanically ventilated critically ill patients

	Non-MV (n=50)	MV (n=43)
Sedation use, n (%)		
Administered	5 (10)	19 (44.2)
Not given with reason	35 (70)	23 (53.5)
Not considered	10 (20)	1 (2.3)
	Non-MV (n=5)	MV (n=19)
Use of sedation scales, n (%)	2 (40)	16 (84.2)
Sedation titration, n (%)		
Doctor's decision	4 (80)	8 (42.1)
Nurse's decision	1 (20)	6 (31.6)
Protocol driven	0	5 (26.3)
Monitoring frequency, n (%)		
Not monitored	2 (40)	1 (5.3)
Hourly	1 (20)	13 (68.4)
4 hourly	2 (40)	3 (15.8)
8 hourly	0	2 (10.5)
Sedative drug, n (%)		
Propofol (IV continuous)	1 (20)	11 (57.9)
Midazolam(IV continuous)	2 (40)	8 (42.1)
Lorazepam (oral)	2 (40)	0
Daily interruption, n (%)		
Done	4 (80)	13 (68.4)

Table 4. Analgesia practices

	Medical (n=53)	Surgical (n=40)	Total (n=93)	p value
Analgesia use, n (%)	13 (24.5)	20 (50.0)	33 (35.5)	0.023
Oral analgesia	9 (17.0)	7 (17.5)	16 (17.2)	0.88
Intravenous opioids	4 (7.5)	13 (32.5)	17 (18.3)	0.005
Assessment, n (%)				
Not monitored	7 (13.2)	4 (10.0)	11 (11.8)	0.905
Monitored				
Informal assessment	5 (9.4)	10 (25.0)	6 (6.5)	0.073
Use of analgesia scales	41 (77.4)	26 (65.0)	67 (72.0)	0.297

Table 4a. Analgesia practices between mechanically and non-mechanically ventilated critically ill patients

	Non-MV (n=50)	MV (n=43)	p value
Analgesia use, n (%)	20 (40.0)	16 (37.2)	0.934
Oral analgesia	16 (32.0)	3 (7.0)	0.007
Intravenous opioids	4 (8.0)	13 (30.2)	0.014
Assessment, n (%)			
Not monitored	8 (16.0)	3 (7.0)	0.309
Monitored			
Informal assessment	4 (8.0)	6 (14.0)	0.551
Use of analgesia scales	33 (66.0)	34 (79.1)	0.246

Table 5. Delirium assessment and management

	Medical (n=53)	Surgical (n=40)	Total (n=93)	p value
Assessment				
None used, n (%)	40 (75.5)	27 (67.5)	67 (72.0)	0.982
Clinical judgment, n (%)	13 (24.5)	13 (32.5)	26 (28.0)	0.537
Use of physical restraints, n (%)	15 (28.3)	12 (30.0)	27 (29.0)	0.984
Sleep promotion, n (%)				
None used	52 (98.1)	23 (57.5)	75 (80.6)	0.001
Daytime lights off	1 (1.9)	17 (42.5)	18 (19.4)	0.001

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