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No-sedation during mechanical ventilation: impact on patient's consciousness, nursing workload and costs

Eva Laerkner, Thomas Stroem and Palle Toft

ABSTRACT

Background: Evidence is growing that less or no-sedation is possible and beneficial for patients during mechanical ventilation.

Aim: To investigate if there was a difference in patient consciousness and nursing workload comparing a group of patients receiving no-sedation with a group of sedated patients with daily wake up, and also to estimate economic consequences of a no-sedation strategy.

Design and methods: Data were collected during a prospective trial of 140 mechanically ventilated patients randomized to either no-sedation or to sedation with daily wake up. From day 1 to 7 in the intensive care unit (ICU), patients were Richmond Agitation and Sedation Scale (RASS) scored, nursing workload was measured with the Nursing Care Recording System (NCR11) and nurse's self-assessment of workload was reported on a Numeric Rating Scale from 1 (*low*) to 10 (*high*).

Results: Patients from the no-sedation group had a median RASS score of −0·029 compared with −2 in the sedated group ($P < 0{\cdot}00001$). The NCR11 scores were higher in the sedated group compared with the no-sedation group: 19·054 versus 17·05 ($P = 0{\cdot}00001$). The nurses self-reported workload was the same in both groups ($P = 0{\cdot}085$). Because of a shorter ICU stay and shorter hospital length of stay in the no-sedation group, we estimated that there will be no cost benefit with the use of sedation and a higher patient to nurse ratio.

Conclusion: Patients receiving no-sedation were more awake with a RASS score close to zero, compared with patients receiving sedation and daily wake up. Nurses reported no difference in self-assessed workload between the no-sedation and sedated group of patients.

Relevance to clinical practice: Patients receiving no-sedation are more awake during their stay in ICU. There might be a potential economical saving with the use of a 1:1 nurse-patient ratio and no-sedation compared with sedation and a 1:2 nurse-patient ratio.

Key words: Mechanical ventilation • No-sedation • Nursing workload • RASS • RCT

BACKGROUND

For critically ill patients undergoing mechanical ventilation, standard therapy has for many years included sedation. However, this has not always been the case. During the polioepidemic in Copenhagen 1952, nurses and medical students worked 24/7 to manually ventilate and support the patients' vital functions during their critical illness (Ibsen, 1954). This was the beginning of a new era; modern intensive care. The gentle hands were changed into machines and in order to make the patients accept this insensitive ventilation, anaesthesia was used to sedate the patients. Sedation moved to some extent focus from the care of the patient to care of the machines. Instead of adjusting the ventilation and general care of the patients, the patients were adjusted to fit the machines and the need of the department:

> *'In the past, nurses and respiratory therapists spent time at the bedside, comforting and caring for their patients, and working skillfully to adjust the machine's performance to meet the patient's needs. Understanding of the delicate*

Authors: E Laerkner, RN, MSc Nursing, Clinical Development Nurse, Department of Anesthesiology and Intensive Care, Odense University Hospital and PhD student, University of Southern Denmark, Odense C, Denmark; T Stroem, MD, PhD, senior doctor, Department of Anesthesiology and Intensive Care, Odense University Hospital, Odense C, Denmark; P Toft, Professor DMsc, Department of Anesthesiology and Intensive Care, Odense University Hospital, Odense C, Denmark

Address for correspondence: E Laerkner, Department of Anesthesiology and Intensive Care, Odense University Hospital, 5000 Odense C, Denmark

E-mail: eva.laerkner@rsyd.dk

machine/patient interface seems to be lost these days; thus the requirement of sedation and paralysis'
(Petty, 1998).

Heavily use of sedation has been characterized as over-sedating, which may prolong mechanical ventilation and increase the risk of complications (Heffner, 2000). During recent years trends in sedation practice towards the use of less sedation indicate that a cultural change in managing mechanically ventilated patients is evolving (Egerod, 2009).

INTRODUCTION

Over the last decade, randomized trials have reported beneficial effects of less sedation. The beneficial effects of a sedation algorithm controlled by nurses was highlighted by a randomized controlled trial by Brook and colleagues (Brook *et al.*, 1999). They reported a reduction in time on mechanical ventilation, reduction in both ICU stay and total hospital length of stay (LOS) with the use of a nurse driven sedation protocol. In 2000, Kress and colleagues reported that a sedation goal and a daily wake up trial reduced the length of mechanical ventilation compared with standard therapy (Kress *et al.*, 2000). In 2008, Girard and colleagues confirmed the findings by Kress. They included a larger number of patients and their main finding beside reduction in LOS was a reduction in 1 year mortality with the use of a daily wake up trial (Girard *et al.*, 2008). These findings have been questioned by a recent Canadian multicenter trial by Mehta and colleagues (Mehta *et al.*, 2012). They randomized patients to a light level of sedation or light sedation and a daily wake up trial. There was no difference in sedation level between the two groups. In this setting with light sedation, the authors reported no beneficial effect with the addition of a daily wake up trial in terms of LOS on mechanical ventilation or in ICU and total hospital LOS. Also no difference was seen with respect to unintentional removal of the tracheal tube or incidence of delirium. The use of sedatives and nurse workload were higher with the addition of a daily wake up trial. This has made the recent American sedation guidelines to recommend either a daily wake up trial or a light level of sedation (Barr *et al.*, 2013). These guidelines also support analgesia-first as a strategy to improve clinical outcome for mechanically ventilated patients (p. 290).

Since 1999, the standard strategy in our intensive care unit (ICU) has been no-sedation, but bolus doses of morphine. In 2010, we published a trial presenting evidence for this novel strategy for the critically ill patient undergoing mechanical ventilation (Strom *et al.*, 2010). We randomized a total of 140 patients undergoing mechanical ventilation. Of those, 70 patients were randomized to the intervention group receiving bolus doses of morphine, but no sedatives and 70 patients were randomized to the control group receiving optimal standard care as described in the Kress and Girard trials with sedation protocols and daily interruption of sedatives. The results were promising with a reduction in length of mechanical ventilation as well as reduction in both ICU and hospital LOS. Approximately 80% of the patients in the intervention group were managed with morphine alone, which demonstrated that control of pain, proximity of nurses and patient reassurance are sufficient therapies (Hughes *et al.*, 2013). However, the original study was criticized in several aspects. Concern was raised that morphine was used as analgo-sedation in the non-sedated intervention group, implying that there were no real difference in patients' consciousness between the two groups.

This is an important aspect, because patients who are more awake might present a challenge for the caregivers; it is presumed more difficult to look after an un-sedated intubated patient. From previous studies, we know that caring for light-sedated patients is perceived a challenge and more demanding for the nurses and they experience an increased workload (Tingsvik *et al.*, 2013; Everingham *et al.*, 2014). Finally, the 1:1 nurse-patient ratio was presumed expensive, not all ICUs considered this model as a real opportunity, even though it is recommended in some standards for ICU staffing (Bray *et al.*, 2010).

We therefore present new data collected during the original trial (Strom *et al.*, 2010). In this article, we focus on differences in patient consciousness between the groups. We also report the nursing workload data collected during the trial. Finally, it is important to report some estimated economic consequences of the strategy with a 1:1 nurse-patient ratio and non-sedated patients.

AIM

To investigate the difference in patient consciousness between critically ill mechanically ventilated patients randomized to a no-sedation strategy and patients randomized to sedation with daily wake up.

To investigate the difference in nursing workload between patients randomized to a no-sedation strategy and patients randomized to sedation with daily wake up.

To illustrate potential economic aspects by using a 1:1 nurse-patient ratio compared with a 1:2 nurse-patient ratio taking into account; The difference in LOS in ICU and total hospital LOS between the two groups.

METHODS

Sample

Data were collected during a prospective randomized trial of critically ill patients undergoing mechanical ventilation randomly assigned to either no-sedation or sedation with daily wake up (Strom *et al.*, 2010). In the original trial as well as in this study, we only reported data from patients receiving mechanical ventilation for more than 48 h.

Data collection methods

Patients in both groups received bolus doses of morphine. Patients in the intervention group received no-sedation, while patients in the control group were sedated with propofol infusion for the first 48 h. After 48 h, propofol was changed to midazolam. The nurse-patient ratio was 1:1 in both intervention and control group. In the control group sedation was adjusted to a RAMSAY score of 3–4 (Ramsay *et al.*, 1974; Strom *et al.*, 2010). All the following measurements were carried out by the nurse, who cared for the actual patient once a day during day-shift (7 am to 3 pm).

To measure patients' level of consciousness in both groups, we used the Richmond Agitation and Sedation Scale (RASS) (Table 1) (Sessler *et al.*, 2002). RASS is a validated sedation score. The RASS score is a 10-point scale from −5 to +4. A score of zero corresponds to a patient being alert and calm. The measurement was made before wake up for the sedated patients.

ICU workload has been described as difficult to measure, and different workload measurement such as Nursing Activities Score (NAS) and Therapeutic Intervention Scoring System (TISS) do not capture all nursing activities and the complexity of caring for critically ill patients in the ICU (Debergh *et al.*, 2012). There is no golden standard for measurement of nursing workload in ICUs. However, prior to the study, we chose to measure nursing workload with Nursing Care Recording System (NCR11) (Walther *et al.*, 2004). As cultural differences between countries may influence the organization and content of nurses' work, NCR11 appeared most appropriate because it was developed and used in a Scandinavian context. The NCR11 is a tool, simple to use with a high inter-rater reliability that supports the use for meaningful comparison of nursing workload between groups (Walther *et al.*, 2004).The workload was measured according to 11 different categories. The categories are related to monitoring and treatment within different organ systems, frequency of procedures, time needed in the care of wounds and drains and care of patients relatives. Within each category the score can be 1 (*low*) to 3(*high*) (Table 2). A point value of zero was given if none of the procedures or measures within the category were performed.

ICU workload measurements generally only focus on the direct procedural care nurses provide to patients (Abbey *et al.*, 2012). Therefore, we wanted to complement measurement with nurses' self-assessment of workload. The nurses' self-assessed workload was measured on a Numeric Rating Scale from 1 (*low*) to 10 (*high*). The nurses stated their subjective number indicating their own perceived level of workload.

Ethical considerations

The randomized controlled trial was approved by the local ethics committee and informed consent was obtained from the patient or the patients' representatives. The study followed the principles of ethical research as stated in the Declaration of Helsinki (WMA, 2013).

Data analysis

Data were collected for the first 7 days of ICU admission or until the patient was discharged. To create a graphic illustration of RASS and NCR11 means for each group (sedated and non-sedated) were calculated for each day and presented in the figures. To calculate the difference between the groups, a median for each patient's measurement during the stay, based on up to 7 days, was calculated and presented in the tables with interquartiles. Data were compared using Wilcoxon Rank-sum test and χ^2 test as appropriate. All tests were performed using: StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP.

To estimate costs of the admission and the cost of an ICU nurse, an admission cost per diem, and an average salary for a Danish ICU nurse were obtained from the economic department at the hospital. The admission costs were estimated in EURO for days at ICU as well as other days in hospital. Cost estimates per diem was applied because the two groups differ by LOS. In the original study, we reported an ICU LOS for the non-sedated group at 13·01 days, and hospital LOS at 34 days, compared with ICU LOS in the sedated group, at 22·08 days and a hospital LOS at 58 days (Strom *et al.*, 2010). We subtracted the ICU stay from the stay in the general ward, because patients were not present in both ICU and general ward at the same time. All patients were cared for with a 1:1 nurse-patient ratio. The 1:2 nurse-patient ratio is only used in theory for the purpose of an simple and rough economical evaluation.

RESULTS

A total of 140 patients were randomized in the original trial and 113 patients received mechanical ventilation

Table 1 The Richmond Agitation and Sedation Scale (RASS) [Sessler *et al.* (2002)]

Score	Term	RASS description	
+4	Combative	Combative, violent, danger to staff	
+3	Very agitated	Pulls or removes tube(s) or catheters; aggressive	
+2	Agitated	Frequent non-purposeful movement, fights ventilator	
+1	Restless	Anxious, apprehensive, but not aggressive	
0	Alert and calm	Alert and calm	
−1	Drowsy	Awakens to voice (eye opening/contact) >10 s	Verbal stimulation
−2	Light sedation	Light sedation, briefly awakens to voice (eye opening/contact) <10 s	
−3	Moderate sedation	Moderate sedation, movement or eye opening. No eye contact	
−4	Deep sedation	Deep sedation, no response to voice, but movement or eye opening to physical stimulation	Physical stimulation
−5	Unarousable	Unarousable, no response to voice or physical stimulation	

Table 2 Nursing Care Recording System (NCR11) [Walther *et al.* (2004)]

Category	1 point	2 points	3 points
Respiratory system	Supplemental oxygen	Ventilator support, weaning	Ventilator support, complex
	CPAP treatment	Endotracheal/tracheostomy tube	
	Inhalation of drugs		
Circulatory system	Stable/unstable, monitored	Stable with treatment	Unstable despite treatment
Renal system	Hourly charting of urine output	Blood purification	Blood purification, complex
		Treatment of oliguria	CRRT
Central nervous system	Clinical examination < 1 h	Clinical examination/1 h	Clinical observation > 1 h
	Alert or drowsy	Very drowsy	Unconscious
	Pain treatment, simple	Pain treatment, intermediate	Severe agitation/confusion
		Convulsions, observation	ICP monitoring
			Convulsions, treatment
Monitoring (BP, HR, BR, Pain)	1–2 times/h	3–4 times/h	>4 times/h
Infusions/injections (enteral or parenteral)	1 infusion	2–3 parallel infusions	>3 parallel infusions
	<1 injection/h	1 injection/h	>1 injection/h
Samples	1–2 samples/8 h	3–4 samples/8 h	>4 samples/8 h
Nursing care	Personal hygiene, self reliant	Personal hygiene, help of 1 person	Personal hygiene, help of > 1 person
	Mobilization, help of 1 person	Mobilization, help of 2 persons	Mobilization, help of > 2 persons
Other monitoring or treatment	Peripheral venous cath	Central venous cath	PA cath
	Urinary catheter	Arterial cath	Sengstaken tube
	Orthopaedic external fixation	Epidural cath.	Cardiac resuscitation
		Lumbar puncture	Monitored patient transfer
Dressings, drains/ostomies	1 drain or ostomy	2–4 drains or ostomies	>4 drains or ostomies
	Dressing changes 1–2/8 h	Dressing changes 3/8 h	Dressing changes > 3/8 h
Care of relatives	Standard	Intermediate	Complex

BP, blood pressure; BR, breath rate; CPAP, continuous positive airway pressure; CRRT, continuous renal replacement therapy; HR, heart rate; ICP, intracranial pressure; PA, pulmonal artery catheter.

for more than 48 h. These patients were enrolled from April 2007 to December 2008. Data from 2 patients were missing. In the present part of the study, we report data from 111 patients from the original trial. Baseline data for these 111 patients are shown in Table 3. More men was seen in both groups, especially the no-sedation group, however, not statistically significant.

In Figure 1, it is shown that patients from the intervention group were more awake through the first 7 days compared with patients from the sedated control group. Patients from the awake intervention group had a median RASS score of −0·029 compared with −2 in the sedated control group ($P < 0{\cdot}00001$) (Table 4).

The NCR11 scores were higher in the sedated control compared with the no-sedation intervention group: 19·054 versus 17·05 ($P = 0{\cdot}00001$) (Table 4). This is also shown on a daily basis in Figure 2. The nurse self-reported workload was the same in both groups as seen in Table 4 ($P = 0{\cdot}085$).

As reported in Table 5, the use of no-sedation and a 1:1 nurse-patient ratio had a potential saving because of a shorter hospital stay in the no-sedation group. From Table 5, it is seen that the costs of a 1:1 nurse-patient ratio are the same as a 1:2 nurse-patient ratio with sedation when taking into account the longer ICU stay. Shown in this hypothetical calculation there

Table 3 Baseline data. Data are in number (%) or median (IQR)

	No-sedation ($n = 53$)	Sedation ($n = 58$)	*P* value
Age (years)	67 (55–73)	65 (57–72)	0·099
Female	13 (25%)	24 (41%)	0·006
Weight (kg)	80 (74–91)	78·05 (70–91)	0·038
Apache II	26 (19–30)	26 (22–31)	0·048
SAPS II	47 (36–56)	50 (43–63)	0·013
SOFA (at day 1)	7 (5–11)	9 (5·05–12)	0·051

SAPS, severity of disease classification system; SOFA, sequential organ failure assessment.

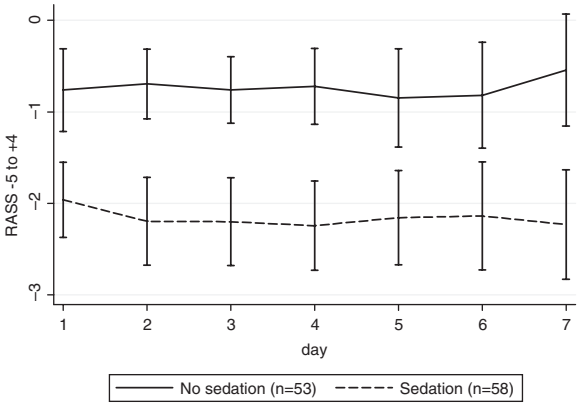

Figure 1 Daily Richmond Agitation Sedation Scale (RASS) score (day 1–7).

is no cost benefit with the use of sedation and a lower nurse-patient ratio, because of a shorter ICU stay and shorter hospital LOS in the no-sedation group.

DISCUSSION

We found that the use of no-sedation actually means more conscious and awake patients compared with sedation with daily wake up trials. Interestingly, we found that the use of no-sedation actually gives a lower nursing workload evaluated by NCR11 compared with the use of sedation. Also the nurse self-assed workload is not higher with patients receiving no-sedation compared with the use of sedation. Finally, we report that a 1:1 nurse-patient ratio and no-sedation does not increase the costs compared with sedation and a 1:2 nurse-patient ratio.

With publication of the original trial (Strom *et al.*, 2010), it has been argued that we might just have changed traditional sedation into analgo-sedation with morphine instead of traditionally sedatives (Ogundele and Yende, 2010). One could argue that the use of morphine introduces some sort of sedation beside analgesia. With the results reported here, we are able to show that the patients receiving the therapy with no-sedation are actually more awake than patients receiving sedation with daily wake up trials. The RASS score is not zero, but a little below which is probably explained by the severely ill patients receiving low doses of morphine. At the same time, our sedated group was only light-sedated with −2 in median RASS score and still there were significant difference in patient consciousness between the two groups measured with RASS.

It is a general perception that more awake patients during mechanical ventilation is a challenge for the ICU nurse staffing. Since 1999, the standard strategy in our department has been to avoid the use of sedation and ensure patient comfort through presence of one nurse for each patient. One of the main findings in the recent trial by Mehta and colleagues was as mentioned that the nurses reported it difficult to do daily wake up trials (Mehta *et al.*, 2012). They had to interact with the patient and to be present by the bedside. This resulted in more sedatives when the patients were put back to sleep. Surprisingly, our result shows that sedated patients score higher in the NCR11 scale than non-sedated patients. This finding is probably driven by more infusion pumps to deliver sedatives to sedated patients which are not the case with the non-sedated patients. The fact that nurses' report no difference in self-assessed workload between the two groups is in contrast to other studies. Metha found that nurses' self-assessed workload was significantly higher caring for patients, who underwent daily sedation interruption compared with patients following a protocol targeting light level of sedation (Mehta *et al.*, 2012). Other studies emphasize that ICU staff finds it more difficult to care for more conscious patients, more demanding for nurses and increasing their daily workload (Everingham *et al.*, 2014; Karlsson and Bergbom, 2015). Our finding with nurses reporting that it is not more demanding with awake patients is probably because of a different culture in our department (Egerod, 2009). In the trial by Mehta, some ICUs had the same 1:1 nurse-patient ratio but not the tradition for awake interacting patients which might explain why nurses reported the wake up trial as an extra workload (ESICM, 2012). It is also interesting to note that our sedated control group with a RASS score of −2 corresponds to the light level of sedation in the trial by Metha (Mehta *et al.*, 2012). This light level of sedation is now recommended in the latest American guidelines (Barr *et al.*, 2013). Caring for light-sedated patients may be more challenging for the ICU nurses than caring for non-sedated patients, as these patients are more awake and conscious and thus able to collaborate with the nurse.

Besides, the obvious advantages with one nurse present around each patient facilitating a lower level

Table 4 Results for Richmond Agitation Sedation Scale (RASS), Nursing Care Recording (NCR11) and nurses self-assessed workload (range 1–10). Data are in number (%) or median (IQR)

	No-sedation ($n = 53$)	Sedation ($n = 58$)	*P* value
Richmond Agitation Sedation Scale (RASS)	−0·029 (−1·014–0)	−2 [−3·024–(−1·000)]	<0·00001
Nursing Care Recording (NCR11)	17·05 (15·025–19·000)	19·054 (18·038–21·029)	0·00001
Nurse self-assessed workload (range 1–10)	4·000 (3·000–5·000)	4·000 (3·092–4·029)	0·085

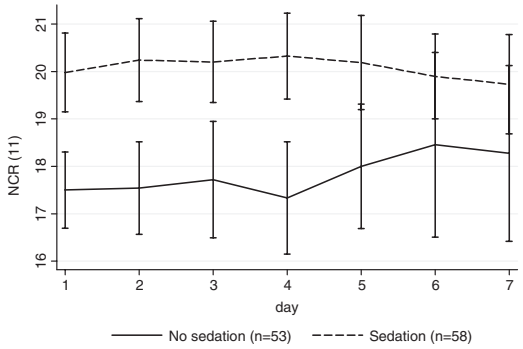

Figure 2 Daily Nursing Care Recording System (NCR11) score (day 1–7).

of sedation; other potential savings need consideration. In our Scandinavian model, nurses take care of continuous renal replacement therapy, where other ICUs normally have personnel from the renal support department taking care of all renal support. Continuous renal replacement therapy is all handled completely by the bedside nurses in Danish ICUs.

Also ventilator adjustments and weaning are managed by the bedside nurses, after direction from the ICU doctors. A cross-sectional survey of sedation practice in Nordic and non-Nordic countries, reports a higher nurse-patient ratio in Nordic countries and highlights that better staffing ratio should be considered in the provision of improved sedation practice (Egerod *et al.*, 2013).

Mobilization is a third task handled by the nurses. Several times a day, most patients are mobilized to a chair, even patients undergoing continuous renal replacement therapy. Evidence is growing that early mobilization has a beneficial effect in terms of LOS, delirium and earlier discharge with a higher degree of independency (Schweickert *et al.*, 2009). The model presented in the study with a 1:2 nurse-patient ratio and sedation would probably further increase LOS because patients with less nursing coverage would be mobilized less if each nurse had to take care of more than one patient.

A last point deserves mentioning: in the department where the study was performed there are free visiting hours; relatives can, if they wish, stay 24/7. With a no-sedation strategy, the possibility exists that the patient can interact and communicate with the relatives and health professionals. This is important for both the patient and relatives, and provides also the caregivers with a unique opportunity to monitor the patient's consciousness.

Some limitations need to be considered when interpreting our results. Data on RASS scores and nursing workload were only collected once a day for the first 7 days. This may not capture daily varieties in patient consciousness and nursing workload; however, we captured the trend over several consecutive days. There is a challenge in analysing and presenting such data. Intensive care stay is very variable in length and no good statistical model exists to compensate for this. To make a compromise, we choose only to record, analyse and report data for the first 7 days.

It could also be argued that the shift to midazolam from propofol after 48 h is a limitation. However, it would be unethical to randomize patients to be treated for more than 48 h with propofol. This would put the patients in a high risk of developing propofol infusion syndrome (PRIS) (Vasile *et al.*, 2003; Kam and Cardone, 2007). Also the choice of morphine instead of shorter acting opioid could be seen as a limitation. However, we only used bolus doses and never infusions. The use of morphine was much lower than seen in other trials

Table 5 Estimated costs in EURO. A strategy with no-sedation and a 1:1 nurse-patient ratio compared with a strategy with sedation and a 1:2 nurse-patient ratio

	Costs ICU	Costs hospital stay	Total costs
No-sedation (intervention group)	1295 € × 13·01 days = 16 965 €	543 € × (34–13·01 days) = 11 348 €	28 313 €
1:1 nurse-patient ratio			
Sedation with daily interruption of sedation (control group)	745 € × 22·08 days = 16 986 €	543 € × (58–22·8 days) = 19 113 €	36 099 €
1:2 nurse-patient ratio			
Savings with a no-sedation strategy	21 €	7765 €	7786 € (22%)

(Kress *et al.*, 2000; Girard *et al.*, 2008). Furthermore, the short acting opioid remifentanil has never been shown to reduce LOS, only weaning time for short stayers (Rozendaal *et al.*, 2009; Tan and Ho, 2009; Spies *et al.*, 2011).

The NCR11 scale favours higher scorings for the sedated patients. Unconscious patients, more infusion pumps and more staff needed to mobilize the sedated patients tend to give higher scorings in this scale. However, the time nurses use to calm and reassure the patient gives no extra points in the NCR11 scale making this less suited to score the complexity of care for more awake patients during mechanical ventilation. The self-reported workload is probably a better scale dealing with conscious patients.

The economical evaluation is based on hypothetical calculated data for the control group because the control group also had a 1:1 nurse-patient ratio in the study. However, one would imagine that a lower staffing could result in less mobilization, less focus on care and therefore longer time receiving mechanical ventilation, ICU and perhaps longer hospital stay making the 1:1 nurse-patient ratio even better than presented in this example. This is supported by studies, which highlight that deeper sedation and the use of patient restraint are associated with high patient to nurse ratio and insufficient staffing in the ICU (Egerod *et al.*, 2013; Arnold *et al.*, 2010; Benbenbishty *et al.*, 2010). The economic calculation is very simple, lacking aspects such as medication and readmission costs. But our calculation shows an interesting potential option to use resources on better staffing in patient care as an alternative to use resources on prolonged stay for patients in the ICU.

CONCLUSION AND IMPLICATIONS FOR PRACTICE

With the use of no-sedation patients were significantly more awake compared with patients receiving sedation and daily wake up. ICU nurses workload was lower in the no-sedation group measured by NCR11. Nurses reported no difference in self-assessed workload between the awake and sedated group of patients. Also there might be a potential economical saving with the use of a 1:1 nurse-patient ratio and no-sedation compared with sedation and a 1:2 nurse-patient ratio. Future research should put more focus on specific nursing competences and challenges experienced by the nurses and the importance of a 1:1 nurse-patient ratio and its implications for care of conscious and awake mechanically ventilated patients in the ICU. This study supports that working with a no-sedation strategy may be both possible and feasible in the ICU.

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WHAT IS KNOWN ABOUT THIS TOPIC

- Less sedation reduces time on mechanical ventilation, time in ICU and total hospital LOS.
- No-sedation is possible and has an additional benefit in terms of reducing LOS.
- A strategy of no-sedation might require a higher nurse-patient ratio than standard treatment with sedation.

WHAT THIS ARTICLE ADDS

- With a strategy of no-sedation but bolus doses of morphine patients have a higher RASS score (close to zero) than patients receiving standard care with sedation.
- Nurses' workload is not higher with a strategy of no-sedation evaluated by NCR11 and nurses self-reported workload.
- A 1:1 nurse- patient ratio might not be more expensive than a 1:2 nurse-patient ratio when patients are kept awake during mechanical ventilation due to the reduced LOS.

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