USE OF PHYSICAL RESTRAINTS IN ADULT CRITICAL CARE: A BICULTURAL STUDY

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BACKGROUND Although controversial, physical restraints are commonly used in adult critical care units in the United States to prevent treatment interference and self-inflicted harm. Use of physical restraints in Norwegian hospitals is very limited. In the United States, an experimental design for research on use of restraints has not seemed feasible. However, international research provides an opportunity to compare and contrast practices.

OBJECTIVES To describe the relationship between patients’ characteristics, environment, and use of physical restraints in the United States and Norway.

METHODS Observations of patients and chart data were collected from 2 intensive care units (n = 50 patients) in Norway and 3 (n = 50 patients) in the United States. Sedation was measured by using the Sedation-Agitation Scale. The Nine Equivalents of Nursing Manpower Use Score was used to indicate patients’ acuity level.

RESULTS Restraints were in use in 39 of 100 observations in the United States and not at all in Norway (P = .001). Categories of patients were balanced. In the Norwegian sample, the median Nine Equivalents of Nursing Manpower Use Score was higher (37 vs 27 points, P < .001), patients were more sedated (P < .001), and nurse-to-patient ratios were higher (1.05:1 vs 0.65:1, P < .001). Seven incidents of unplanned device removal were reported in the US sample.

CONCLUSIONS Critical care units with similar technology and characteristics of patients vary between nations in restraint practices, levels of sedation, and nurse-to-patient ratios. Restraint-free care was, in this sample, safe in terms of treatment interference. (American Journal of Critical Care. 2005;14:133-142)

The use of physical restraints in acute and critical care settings in the United States and other countries has come under intense scrutiny in recent years. Although often considered an acceptable standard of practice, the use of physical restraints is associated with physical, psychological, ethical, and legal problems. Restraints may be used to protect patients from a greater risk of harm, although evidence is lacking to support the effectiveness of using physical restraints to prevent treatment interference. Adverse outcomes associated with use of restraints include the complications of immobility, emotional devastation, serious injuries, and death. Ethical concerns are related to patients’ right to autonomy and dignity, whereas the right to a safe working environment has been raised as an ethical justification for restraining disoriented and aggressive patients.

Alternative methods of managing patients may be difficult to study experimentally. However, international and comparative research offers a design in which the safety of restraint-free care can be examined in various contexts. In an effort to explore the differences in practice between countries, we undertook this study to examine traditional use of physical restraints versus limited use or no use of restraints.

Literature Review

Use of physical restraints became an accepted standard of practice in the United States during the
Although restraints are used in 13% to 50% of intensive care units in the United States, their effectiveness in reducing falls or preventing interference with devices has never been documented.

Certain characteristics of patients are more strongly associated with the use of physical restraints. Advanced age, disruptive behaviors, the presence of invasive devices, and cognitive impairment are associated with greater use of restraints. Clearly, the most common reasons for using restraints are to prevent falls and to prevent interference with invasive devices. 

The effectiveness of physical restraints in reducing rates of falls or preventing interference with devices has never been documented. Patients who are restrained do fall and may sustain more serious injury because part of their body is tied to the bed or because they fall from a greater height after climbing up and over a side rail. Patients have died as a result of being suspended from beds or chairs by straps or vest restraints and by being entrapped in side rails. Studies of device interference, specifically self-extubation, have indicated that restraints are also ineffective for this purpose. In a review of 8 studies published before 1995, the percentage of patients physically restrained at the time of self-extubation ranged from 41% to 91%.

Characteristics of the environment have also been cited as contributing factors in the decision to use restraints. In general medical-surgical and critical care units, environmental factors such as unwanted noise, unnatural light, and social isolation can influence the occurrence of delirium, agitation, anxiety, and disorientation. The environmental structure, designed to enhance patients’ privacy and dignity, may limit staff members’ ability to monitor patients. These factors, in addition to a practice culture that does not support keeping the nurse at the bedside of acutely or critically ill patients, contribute to the use of physical restraints for the perceived safety of patients.

The research-based knowledge on the adverse outcomes associated with physical restraints and the lack of documented beneficial effects are inconsistent with the still widespread practice, in some cultures, of using physical restraints. It is unclear what strategies will successfully reduce the use of physical restraints in critical care settings. Anecdotal information indicates that the use of physical restraints in Norwegian critical care units is very limited. For this study, access to practice settings in both Norway and the United States provided an opportunity for collaboration in comparative research.

Purpose
The purpose of this study was to describe the relationship between patients’ characteristics, environment, and actual use of physical restraints in selected critical care units in Norway and the United States. We expected that results would uncover patient management strategies that could be used to promote a reduction in the use of physical restraints.

The research questions were (1) Is use of physical restraints related to patients’ characteristics? and (2) Is use of physical restraints related to the environment?

Methods
Design and Sample
A descriptive, correlational design was used for this observational study. Appropriate ethical approval for a research study was obtained in each country. For this study, physical restraints were defined as “all patient care articles (straps, bed linen, vest) used as an intervention to restrict a person’s freedom of movement or access to their own body.” Although tangential to the concept, side rails were not considered restraints.
Power analysis indicated that a sample size of 100, 50 patients in each country, would be sufficient to achieve statistical significance at $\alpha = .05$. One researcher collected data in each country for 10 weeks. The researcher visited each unit sequentially, 1 unit per weekday, compiling data from 3 ICUs in the United States and 2 ICUs in Norway. Review of each unit’s census allowed determination of which patients met the inclusion and exclusion criteria. Patients were enrolled until the predetermined sample size was reached. Inclusion criteria were designed to avoid a selection bias toward the more transient ICU population: age greater than 18 years, ICU length of stay greater than 12 hours for patients not undergoing open heart surgery, and a stay greater than 24 hours with a further expected stay greater than 6 hours for patients undergoing open heart surgery. Patients were excluded from the study if they were awaiting diagnostic procedures to confirm a tentative diagnosis of brain death or if active ICU treatment had been withdrawn and only comfort measures were being provided. Each patient who met the criteria was entered only once into the study.

Data Collection and Instruments

Chart review and interviews of nurses provided data on patients’ characteristics: age, sex, race, diagnostic category, impaired vision or hearing, family visitation, sedatives and analgesics given, behavior leading to use of restraints (interference with invasive devices, sitting up, and climbing out of bed), and adverse outcomes (nosocomial skin impairment, unplanned removal of an invasive device, falls).

Data on level of activity and use of physical restraints were collected by direct observation; each patient was observed twice, yielding a total of 100 observations in each country. Patients’ activity level and actual use of physical restraints were observed at 7 AM in order to mirror conditions at the end of a night shift. A second observation was done later in the morning to study conditions at a time of day when the frequency of interventions and the amount of available resources were thought to be highest. Patients’ activity levels were scored by using the Sedation-Agitation Scale (SAS),25 slightly modified for this study (Table 1). After pilot testing, additional examples were included in the instrument to clarify scoring according to frequency of behaviors, a modification also discussed by Riker et al26 in a later evaluation of the original scale. Restraints were classified by type: wrist, ankle, soft, vinyl or leather, vest, purposeful placement of bed linen, and binder or dressing.

The environment was described according to number of beds and bed configuration (private rooms, semi-private rooms, open wards). The study was limited to units in which continuous monitoring was available.

### Table 1: Sedation-Agitation Scale with modifications used in this study

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
</table>
| Continuous/frequent thrashing, attempting to strike staff, frequently trying to climb out of bed, pulling at endotracheal tube/catheter, cannot be calmed with verbal or tactile stimuli | Patients awaiting diagnostic procedures to confirm a tentative diagnosis of brain death or if active ICU treatment had been withdrawn and only comfort measures were being provided.

#### Table 1: Sedation-Agitation Scale26 with modifications used in this study

<table>
<thead>
<tr>
<th>Original Sedation-Agitation Scale</th>
<th>Descriptors used in study</th>
<th>Original score</th>
<th>Study scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate threat to safety</td>
<td>Continuous/frequent thrashing, attempting to strike staff, frequently trying to climb out of bed, pulling at endotracheal tube/catheter, cannot be calmed with verbal or tactile stimuli</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Dangerously agitated</td>
<td>Requires frequent (&gt;4 times per hour) reminding of limits, frequently biting at endotracheal tube, occasionally thrashing; frequently tries to sit up, is not easily calmed with verbal reminders</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Agitated</td>
<td>Tries to sit up &lt;4 times per hour, occasionally moves extremities, rarely thrashes, only intravenous catheters threatened, easily calmed with verbal reminders</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Calm and cooperative</td>
<td>Calm, easily arousable, follows commands</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Oversedated</td>
<td>Cannot consistently follow commands, difficult to arouse with verbal/tactile stimuli, cannot attend to conversation</td>
<td>-1</td>
<td>5</td>
</tr>
<tr>
<td>Very oversedated</td>
<td>Arouses to noxious stimuli only, withdraws or localizes to pain</td>
<td>-2</td>
<td>6</td>
</tr>
<tr>
<td>Unarousable</td>
<td>Does not arouse to any stimuli</td>
<td>-3</td>
<td>7</td>
</tr>
</tbody>
</table>
open bay, partial walls), nurse-to-patient ratio, and nursing workload per patient. The nurse-to-patient ratio was assessed at 7 AM and was also averaged for the preceding 24 hours. Students or preceptees under direct supervision were not included in staffing numbers. Nursing workload was determined by using the Nine Equivalents of Nursing Manpower Use Score (NEMS). The NEMS has 9 categories of weighted items that require nursing care. Patients are given the score for each category if the interventions in that category have been implemented within the preceding 24 hours. The scores received in the 9 categories are added to get a total score. The range of scores is from 0 (minimal nursing manpower required) to 56 (maximum nursing manpower required). As shown in Table 2, higher scores reflect greater dependence on technology.

### Data Analysis

Standard statistical methods were used for data analysis, including \( \chi^2 \) tests for nominal scale values, and the Student \( t \) test for values on an interval scale. Data measured on the ordinal scale were compared by means of the Wilcoxon signed-rank test. A logistic regression model was used to determine if demographic factors and patients’ characteristics correlated with whether or not the patient was restrained. A \( P \) value of less than .05 was considered significant.

### Results

Both research questions showed significant associations. Use of physical restraints was associated with patients’ activity, and patients were restrained in about 40% of observations in the United States. Patients in the US groups had greater activity and received smaller amounts of sedatives and/or analgesic medications than did patients in the Norwegian groups. With regard to the environment, the Norwegian units had higher workload scores per patient and higher nurse-to-patient ratios than did the US units.

***Restraints were observed 40% of the time in US subjects, whereas no restraints were observed in the Norwegian sample; Norwegian subjects were more sedated.***

### Actual Use of Restraints

The most common type of restraint used was soft wrist restraints, and the most frequent behavior reported that led to use of restraints was interference with an
invasive device. The 2 countries differed significantly in actual use of restraints. No use of restraints was observed in the Norwegian study group; in the US study group, physical restraints were being used at 39 of 100 observations ($P=.001$; Table 3). At 7 AM, 21 patients in the US study group had one or both wrists restrained; 2 patients had an additional vest restraint. At noon, 1 patient wore a vest restraint, and 17 other patients had one or both wrists restrained. Examples of what may be considered least intrusive restraints, such as bulky dressings or mitts to prevent fine motor interference with treatment, or most intrusive restraints, such as leather restraints on all extremities, were not observed. The relationship of SAS scores to use of restraints in the US sample is illustrated in Figure 1.

**Figure 1** Patients in intensive care units in the United States, restrained versus nonrestrained by level of sedation (score on Sedation-Agitation Scale) and time of day.

**Figure 2** Level of sedation (score on Sedation-Agitation Scale) by country at 7 AM and noon.

**Characteristics of Patients**

Diagnostic category, age, sex, and visual or hearing impairment documented before arrival in the ICU did not differ significantly between patients from the 2 countries (Table 4). Race did differ significantly; all patients in the Norwegian study group were white. Family visitation during the previous 24-hour period did not differ significantly between groups, and patients received visitors during a median of 2 of 3 eight-hour shifts in both countries. Patients’ activity level, as indi-
cated by SAS scores, differed significantly between the 2 groups. The patients in the United States had a lower score (Figure 2), indicating more activity ($P < .001$). The SAS score was significantly lower for US patients than for Norwegian patients at both observation times (Table 5).

On a 24-hour basis, morphine sulfate was the most frequently administered analgesic with sedative properties, given to 61 of 100 patients (Table 6) in doses varying from 0.03 to 18.98 mg/kg every 24 hours. Morphine sulfate was administered at a substantially higher dose in the Norwegian sample, with a Norwegian median of 1.31 mg/kg versus a US median of 0.17 mg/kg every 24 hours. Current unit practice did not allow comparison of target levels of sedation, because the usual prescription for sedatives and analgesics was “as needed.”

The frequency of nosocomial skin impairment did not differ significantly between groups. No falls were reported in either group. Seven incidents of unplanned removal of an invasive device occurred in the US study group. All incidents occurred in restrained patients and included the removal of intravenous catheters (peripheral and central) and nasogastric tubes.

Unplanned removal of devices occurred only in the US sample.

### Environment

The study units in each country were located in teaching hospitals in large metropolitan areas. Unit capacity was from 7 to 14 beds. Four units had a mix of private and open bay rooms, 1 unit (in the United States) had 8 private beds. Each US unit had a central nurses’ station; the Norwegian units were decentralized. Admission policies varied. One of the Norwegian units had intensivist-led medical management; the other unit was part of the bed continuum of a surgical department. The US units were patient-population specific, but admission policies were open.

The nurse-to-patient ratio for the 24 hours preceding observation differed significantly between countries. The ratio for the Norwegian sample was 1.05:1 in contrast to 0.65:1 for the US sample ($P < .001$). Nursing workload per patient as indicated by NEMS scores differed significantly between countries, with overall medians of 37 points in the Norwegian sample and 27 points in the US sample ($P < .001$). After adjustment for nursing workload (NEMS score), the Norwegian nurse-to-patient ratio remained higher than the ratio in the US units. Details for various categories of patients are provided in Table 7.

### Discussion

The use of physical restraints to prevent treatment interference has historically been based on the goal of
protecting patients from the harm associated with unskilled removal of a device.24 In Norway, interventions to achieve this goal have traditionally not included the use of physical restraints. Rather, a norm has prevailed for nurses to remain within a distance that allows direct visual observation and eye contact with intubated patients, both to avoid isolation and to be alert for sudden behavioral changes. Devices commercially available in the United States, such as soft wrist restraints and vest jackets, are not marketed to the critical care community in Norway. Additionally, the word restraint does not have a direct Norwegian translation in somatic hospital jargon; close translations might be to tie (binde) or to place in leather limb restraints (legge i remmer). One might assume that use of restraints in a culture where this practice is less prevalent would be viewed as more intrusive to patients’ autonomy. In a recent revision of law governing patients’ rights, effective 2001, the Norwegian government strengthened language related to informed consent for care and patients’ role as a partner with care providers. Thus, attention to social norms as well as regulations governing consent to treatment would be required to avoid practicing on the border of existing formal and informal standards. The differences observed in this study suggest that the use of restraints should be discussed within a wider perspective than the observational data presented here. The cultural and moral issues involved contain elements of necessity, practicality, dignity and autonomy, and distribution of resources.

Use of restraints reflects not only healthcare practices but also cultural norms and governmental regulations.

Necessity is linked to protecting patients from potentially life-threatening interference with treatment,9 and such interference is assumed to be related to patients’ activity. Although observations indicated that US patients had a greater activity level (ie, score on the SAS) than did Norwegian patients, interpretation of SAS scores may be confounded by the potential ability of physical restraints to increase agitation. Were the more active, agitated patients placed in restraints, or did the patients who were in restraints become more active and agitated? The NEMS score is sensitive to technology dependence and organ dysfunction, and it can logically be considered a surrogate score for vulnerability from consequences of treatment interference. The differences in NEMS scores between groups indicated that the Norwegian study patients were more dependent on technology. However, restraint-free care was safely provided to this group, thus challenging a universal and necessity-based argument for use of restraints.

Choices between restraints and sedation could be based on practical reasons, for example, balancing considerations for comfort against promoting recovery. More sedated patients might be calm and comfortable, although slower to recover muscular, respiratory, and digestive functions. More active patients might endure the inconvenience of restraints to allow a more speedy recovery and ease of neurological observation. What is considered an ideal level of sedation depends on the disease, the treatment involved, and the resources available.

A difference in administration of medication by nation was noted. Further investigation of data revealed that the Norwegian patients received more units of sedative and analgesic medication per kilogram per 24 hours, received more complex combinations of sedative and analgesic medications and scored—except for the cardiovascular subgroup—lower on the activity scale. Thirteen of 14 cardiovascular patients in the Norwegian sample were admitted to the same unit. Their NEMS scores were higher, and the SAS scores indicated equal or more activity than in the corresponding US group, suggesting an influence of unit-to-unit

| Table 5 | Score on the Sedation-Agitation Scale by nation and diagnostic category* |
|---|---|---|---|
| Diagnostic category | Score at 7 AM | Score at noon |
| | United States | Norway | United States | Norway |
| Surgical/trauma | 4 (3-6) | 5 (4-6) | 4 (3-6) | 5 (4-6) |
| Neurological/isolated head trauma | 4 (2-7)* | 6 (4-7) | 4 (3-7)* | 6 (4-7) |
| Medical | 5 (4-6) | 6 (5-7) | 5 (4-6) | 6 (6-7) |
| After open heart surgery | 4 (4-7) | 4 (4-6) | 4 (4-7) | 4 (4-6) |
| Overall | 4 (2-7) | 5 (4-7) | 4 (3-7) | 5 (4-7) |

*Scores are median and (minimum-maximum).
†One patient was receiving neuromuscular blocking agents, score = 7.
may influence the decision to restrain patients. 7,15,28,30,31

Anecdotal information suggests different interventions are provided and managed by the nurse-physician team. Unlike in the US units, respiratory therapists are not used in Norway. All oxygenation and ventilation services to a larger population of patients while controlling costs at acceptable safety levels. In this study, the Norwegian units had more registered nurses per patient than did the US units, even after statistical adjustment for NEMS scores. The same staffing level in a US unit would increase variable costs and tie up nursing resources. However, it does not necessarily follow that the number of hours per patient available for restraint-reducing nursing interventions equals the difference in staffing ratios between the 2 nations.

Although the formal scope and practice of nursing in ICUs are similar in the 2 countries, organization and delivery of direct and indirect care differ between them, influencing the total amount of human resources available. Unlike in the US units, respiratory therapists are not used in Norway. All oxygenation and ventilation interventions are provided and managed by the nurse-physician team. Anecdotal information suggests differences between nations in the use of allied healthcare providers and support staff, with more frequent use in the United States of unlicensed nursing assistants, as well as unit secretaries and housekeeping staff. Hence, the staffing ratio required to provide a given standard of bedside nursing care is influenced by factors other than the number of occupied beds at any time. The admission and discharge criteria of each unit, frequency and duration of indirect care tasks, coverage by physicians, availability of adequately trained assistants, amount of technology in use, and the characteristics of individual patients are also relevant pieces of information. Staffing ratios remain but one of multiple factors in complex interaction that are linked to direct care delivery in the ICU, reminding us of the challenges of comparative research31 and of the caution that must be used when drawing causal inferences.

More research is needed to balance the scales between sedation, use of restraints, and staffing patterns. The relationship of staffing patterns to variable costs suggests that nurse-to-patient ratios be included as a standard background variable when the process and outcomes of critical care are being studied. Adding to clinical variables as observed by healthcare workers, relevant patient-reported outcomes might include experiences of being restrained during critical care. Thus, findings of this study support a call for standardization as well as for rich descriptions of relevant background variables: goals of sedation practices; target levels of sedative effect; staffing patterns, including formal training; and presence or absence of use of restraints. An outcomes-oriented research approach9 might target the effectiveness of restraining therapies.

The final perspective of autonomy is harder to study empirically and culture appropriately. Where the practice of restraining is ingrained, attitudes toward restraints may be internalized to the extent that a potential for violation of dignity and autonomy ceases to be explicitly questioned. As an illustration, the original SAS level +2 (Table 1) presupposes restraints as part of the standard of care, whereas the same text might be considered inappropriate in a restraint-free environment. Valid and nuanced objections exist to both the use of physical restraints and to liberal seda-

Table 6  Sedatives/analgesics administered

<table>
<thead>
<tr>
<th>Sedative/analgesic</th>
<th>United States</th>
<th>Norway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine sulfate</td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Opioids, other</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Ketobemidon</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Paracetamol with or without codeine</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Midazolam</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Propofol</td>
<td>5²</td>
<td>17¹</td>
</tr>
<tr>
<td>Diazepam</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Meperidine</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

¹One patient received vecuronium 1.11 mg/kg per 24 hours while sedated with propofol.
²One patient received a single dose of pancuronium while sedated with propofol and midazolam.

Norwegian nurses maintain direct visual observation of patients, respiratory therapists are not used at all, and unlicensed personnel are used less frequently than in the United States.
tion, indicating an obligation to consider ICU practices from more than a single ethical perspective. The individual values of patients are seldom known in advance, and consent to use of restraints has not been required, although orientation to the intervention is provided. The imbalance of autonomy in the provider-to-patient relationship might mandate that the stronger of the 2 be morally articulate and responsible for choices that affect the patient’s possibilities for self-determination. In contrast to Strumpf and Evans’ study,32 ICU survivors interviewed by Minnick and coworkers13 reported relative indifference to the use of restraints. A risk of bias inherent in a small survivor sample may be considered in the latter study. As the evidence on patients’ experiences of being placed in restraints is contradictory, moral responsibility rests with the individual provider as guardian of the autonomy of vulnerable and cognitively impaired patients.

Limitations

Potential confounding variables and weaknesses of this study include the possibility that documentation and staff responses to the interview questions may be inconsistent with actual practice. Some factors that might influence patients’ characteristics, such as metabolic imbalances, were not measured. Interpretation of ICU research is complicated by the difficulty in directly measuring pain and results of analgesia through patients’ self-reports. Also, data collected on medication and sedation scores may provide limited information about actual practice patterns. Cultural, gender, or other individual differences in the patients and staff may influence responses to critical illness and level of participation in care.

Conclusion

Restraint practices, levels of sedation, and nurse-to-patient ratios varied between critical care units in the United States and Norway that had similar technology and patients with similar characteristics. In this study, care in a restraint-free environment was safe for a small sample of patients. Larger scale studies are needed to determine the effectiveness of restraint-free care compared with conventional restraint practices in critical care settings, including use of nonpharmacological interventions such as education of patients and use of nonprofessional staff or family members on the healthcare team.

Comparison of practices in different cultural settings facilitates a bilateral renewal of perspectives on the use of physical restraints and how to protect patients from adverse events due to the critical care environment. The comparative focus is bidirectional; as one studies another context, one is made aware of one’s own environment.

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We appreciate the assistance from Brit E. Fredriksen, Susan T. Gibbs, and Scotty Stunmoen with translation of informational material and the Sedation-Agitation Scale. We thank Dr Karen Martin for assistance with statistical advice and analysis of the data from this study.

Commentary by Mary Jo Grap (see shaded boxes).

REFERENCES


Table 7 Nine Equivalents of Nursing Manpower Use Score (NEMS) by nation and diagnostic category*

<table>
<thead>
<tr>
<th>Diagnostic category</th>
<th>United States</th>
<th></th>
<th>Norway</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of patients</td>
<td>NEMS</td>
<td>No. of patients</td>
<td>NEMS</td>
</tr>
<tr>
<td>Surgical/trauma</td>
<td>19</td>
<td>27 (18-44)</td>
<td>15</td>
<td>34 (18-45)</td>
</tr>
<tr>
<td>Neurological/isolated head trauma</td>
<td>20</td>
<td>27 (15-40)</td>
<td>17</td>
<td>39 (27-45)</td>
</tr>
<tr>
<td>Medical</td>
<td>2</td>
<td>33 (27-39)</td>
<td>4</td>
<td>44 (32-50)</td>
</tr>
<tr>
<td>After open heart surgery</td>
<td>9</td>
<td>39 (25-45)</td>
<td>14</td>
<td>39 (18-50)</td>
</tr>
<tr>
<td>Overall</td>
<td>50</td>
<td>27 (15-45)</td>
<td>50</td>
<td>37 (18-50)</td>
</tr>
</tbody>
</table>

*NEMS scores are median and (minimum-maximum).
†Mann-Whitney-Wilcoxon test.


