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Mechanical restraint and characteristics of patient, staff and shifts in a psychiatric ward

Johanne Sofie Kodal\textsuperscript{a,b}, Jesper Nørgaard Kjærb and Erik Roj Larsena

\textsuperscript{a}Department of Affective Disorders Q, Mood Disorders Research Unit, Aarhus University Hospital, Aarhus, Denmark; \textsuperscript{b}Psychiatric Research Academy, Department of Affective Disorders Q, Aarhus University Hospital, Aarhus, Denmark

ABSTRACT

Background: The use of coercion is a balance between depriving the patients’ autonomy and dignity and preventing endangerment of the body or health of self or others. It is of importance to obtain more knowledge about mechanisms leading to mechanical restraint in the attempt of reducing it.

Objective: To analyse for associations between incidence of mechanical restraint (MR) and staffing level, staff demographics, patient characteristics, type of shift (day/evening/night) and change of shifts.

Method: A naturalistic descriptive method was used to study cases of MR in a psychiatric ward. Data for each case of MR was obtained from an electronic reporting system. Care workers from each shift were identified using duty rosters. Analyses included binary logistic regression analyses.

Results: In 82\% of the 114 cases of MR, the patient was diagnosed with personality disorders. In the multiple regression analysis, a significant association was found between the use of MR and the presence of male care workers on the ward (OR:1.44, 95\% CI: 1.01–2.05; \(p = .04\)). Moreover, MR was associated with evening shifts, compared with day and night shifts (OR = 1.29, 95\% CI: 1.14–2.57, \(p = .01\)). Besides, months from January to December was associated with a decrease in MRs (OR: 0.88, 95\% CI: 0.83–0.94; \(p = 7.3 \times 10^{-6}\)). No significant associations were found between MR and staffing level or experience.

Conclusions: MR was associated with evening shifts, higher number of male care workers on duty and a decrease from January to December.

Background

Over decades, an increased focus on the use of mechanical restraint (MR) in psychiatry has been present, from the ward to a political level \([1]\). The use of restraint creates significant risks for serious injury, re-traumatisation of people who have a history of trauma, and loss of dignity \([2]\). Restraint should be used only when there exists an imminent risk of danger to the individual or others and no other safe and effective intervention is possible. In the attempt of reducing the use of MR, it is of interest to obtain more knowledge about the circumstances in which it is used \([3,4]\).

In 2014, The Ministry of Health and The Danish Regions (administrative unit responsible for health care) agreed that the proportion of patients undergoing MR should be reduced with 50\% in 2020 \([5,6]\). Furthermore, it was decided that use of coercion in general should decrease \([6]\). Strategies used in order to reduce coercion were placed in the regions to decide.

Many risk factors leading to MRs may be considered. Attention has been paid to patient-related factors as well as organisational factors \([3,7–9,13,14]\). A higher risk seem to be related to patients with schizophrenia compared to patients with mood disorders \([11]\) as well as patients of male gender \([11]\) and involuntary admissions \([12,13]\). Evidence concerning staff level is conflicting \([3,7–9,13,14]\). In a multiple hospital system in USA, MRs occurred with the highest risk in the night shift (48.8\%) \([14]\). A review of the literature from 2010 concluded that development of new seclusion and restraint reduction programmes should include strong leadership from local management; external seclusion and restraint review committees or post-incident debriefing and analysis; broad-based staff training and programme changes at a local level \([15]\).

According to Danish law of Psychiatry, MR must be initiated only when necessary in order to prevent a patient from endangering his/her own or others’ body or health; prevent persecution or harassment of other patients and/or prevent substantial vandalism \([16]\). MRs used in our department are enforced fixation to the bed by use of a leather belt around the waist, wrists or arms. Restrained patients are not left alone, but have a staff member sitting outside an open door 24 h a day in order to talk with the patient and to secure that everything is safe.

Use of seclusion is not legal under Danish law \([17,18]\). The incidence of MR varies between European countries, presumably partly as a consequence of differences in national legislation regarding types of coercion. While MR is prohibited in UK, seclusion is prohibited in Denmark \([17]\). In 2012,
Bak et al. showed that use of physical coercion/100,000 inhabitants was less used in Norway (29/100,000) compared to other countries as Denmark (52/100,000), Finland (71/100,000) and Sweden (101/100,000) [17]. Besides, they suggested that preventive factors such as a higher number of staff members and education could explain the difference between the use of MR in Norway compared to Denmark [19,20].

Our hypothesis is that number and characteristics of care workers and change of shifts could contribute to the amount of MRs used.

**Objective**

To analyse the associations between the incidence of MR and staff level, staff demographics, patient characteristics and shift of staff. As 82% of MR was completed in younger patients suffering from personality disorders, patient characteristics were not included in the analyses.

**Materials and methods**

**Setting**

The mood disorder unit, Department Q, consisted of 4 wards, of which we studied Q1. Each ward had 17 rooms with a bed and a bath room. If no patients are under restraints it is possible to unlock the main entrance.

**Design**

A naturalistic descriptive study. It has been crucial to us that information from this department is published in a way that individual patients or staff member may not be recognised.

**Sample**

Hospitalised patients with anxiety, depression, bipolar disorders and personality disorders aged 18–67 years.

**Inclusion criteria**

Admission to the psychiatric in-patient department Q1 at Aarhus University Hospital, Denmark, in the period 1 July 2013 until 30 June 2014.

**Measures**

The exposures were shift, change of shifts, weekday, month, patient’s age, gender and diagnosis, care workers’ age, gender, education and experience at the specific ward. Outcome was MR.

**Mechanical restraint (MR)**

In this paper, MR was defined as enforced fixation to the bed by use of a leather belt around the waist. No attention was paid to additional fixation with straps around arms and legs.

Knowledge of each case of MR was obtained from Statens Serum Institut’s (SSI) Electronic Reporting System (SEI). SSI is under the auspices of the Danish Ministry of Health. MRs in Denmark are mainly initiated as a consequence of affect, self-harm and externalising behaviour. The patient does not need to be involuntarily hospitalised or psychotic. No restraints are done without confirmation and presence of a medical doctor. Immediately afterwards, the doctor uses an electronic patient formula to register indications for restraint. The duration and the hour of the day for initiating MR are reported to SEI by use of the formula by a secretary. Three times a day a doctor from the department must evaluate the restrained patient. If the restraint lasts for more than 24 h, a doctor from another psychiatric department must pay the patient a visit to evaluate if the indications for restraint are fulfilled. External evaluations are repeated after respectively 48 h, 4 days and then weekly, as long as the restraint is ongoing. After 30 days of restraint, the Danish Health Authority must be informed. Besides, it is added to the law that staff members must pay attention to meet patient perspectives in a proper solution.

**Patient and staff characteristics**

Age, gender and diagnosis of the restrained patients were registered. If a patient was restrained more than once during the study period, the diagnosis could vary between cases of MR. A patient’s diagnosis was included each time a MR was carried out. Care workers on each shift were identified using duty rosters for each month. Age, gender (male/female), education (psychiatric nurse/psychiatric health care assistant/psychiatric nursing aid/unskilled) and experience of each care worker (defined as years of employment at the specific ward) were registered. Psychiatric nursing aids with a 1-year education (that no longer exists) are being replaced by psychiatric health care assistants with a 3-year education. Members of the regular staff should cover the observation of the first restrained patient themselves, but extra staff could be called in already in the same shift if assistance was required. When regular staff could not cover the shifts, the ward used external care workers. They were registered as a separate variable (present or not) but further characteristics could not be obtained. Medical students working as substitute care workers were registered separately.

**Shifts and change of shifts**

Shifts run as follows: day shift: 7 a.m.–3 p.m., evening shift: 3 p.m.–11 p.m., night shift: 11 p.m.–7 a.m. At each shift, it is endeavoured that all employees at the department are changed. One care worker stays half an hour longer to increase security. Change of shifts was defined as 1 h before and after the actual change of shifts, specifically 6 a.m. to 8 a.m. (morning), 2 p.m. to 4 p.m. (afternoon) and 10 p.m. to 12 midnight (night).

**Statistical analysis**

The distribution of MRs related to number of care workers during shifts and gender were analysed in a two-sided
Pearson’s chi-square test. Besides, the associations between MR and staff demographics and patient characteristics as well as the distribution of MRs between shifts, change of shifts, weekdays, and months were analysed in a binary logistic regression model. The dependent variable (restraint) and the independent variables were all included as binary variables in the regression analysis. Independent variables were entered in the binary logistic analysis as single variables (model A). Hereafter, variables with $p < .2$ were entered in a multiple regression analysis forward stepwise (FSTEP) and the model adjusted (model B). A $p$-value of .05 or less was considered statistically significant. Hosmer–Lemeshow goodness of fit was applied. We used the statistical package SPSS version 20 [21]. The Danish Central Data Register approved the study. As three individuals were responsible for 77% of restraints used, we performed a linear regression analysis with the predictors of interest from the binary logistic regression analysis to examine multicollinearity. The latter refers to unacceptable high correlations between predictors. Diagnostic for multicollinearity, the variance inflation factor (VIF) was 1.005–1.031 indicating, that it is unlikely to be a problem.

Results

During the 1-year study period, MR took place 114 times in 20 patients. Of these, 88 (77%) restraints occurred in three patients. The median duration of MR in all cases was 9.7 h (range 0.2–330.1 h). A total of 104 cases (91.2%) of MR were in female patients, and 10 (8.8%) in male patients. Mean age was 29 years (SD 6.2). A total of 93 cases (82%) of MR were completed in patients suffering from personality disorders (ICD-10: F60.3 and F60.9) and 11 cases (9.6%) in patients with mood disorders (F31–33).

Gender, age, experience and education of the regular staff are presented in Table 1.

Table 1. Staff demographics in the study period.

<table>
<thead>
<tr>
<th>Psych. nurses</th>
<th>Psych. health care assistants</th>
<th>Psych. nursing aid</th>
<th>Unskilled</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>14</td>
<td>15</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Female (%)</td>
<td>13 (93%)</td>
<td>13 (87%)</td>
<td>2 (67%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>Male (%)</td>
<td>1 (7%)</td>
<td>2 (13%)</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Median age in years (min.–max.)</td>
<td>28.5 (22–61)</td>
<td>37 (22–55)</td>
<td>59 (57–60)</td>
<td>23</td>
</tr>
<tr>
<td>Median experience in years (min.–max.)</td>
<td>2.5 (0–14.5)</td>
<td>2.5 (0.5–18.5)</td>
<td>34.5 (5.5–39.5)</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2 shows information of number and mean duration of hospitalisation at departments Q1 compared to department Q overall, as well as unique numbers of compulsions and patients restrained.

The number of MRs was highest at the beginning of the year (Pearson’s chi-square test, $p = 0.0001$). January and February numbered 36 cases (31.5%). The distribution of MRs between weekdays ranged from 10 (8.8%) on Saturdays to 27 (23.7%) on Thursdays (non-significant). The highest proportion of MRs was seen in the evenings as seen in Table 3. MR took place 54 times (47.4%) in evening shifts, 30 times (26.3%) in day shifts and the same number in night shifts. A total of 32 cases (28.1%) of MR took place during change of shifts; 5 in the morning (6 a.m. to 8 a.m.), 8 in the afternoon (2 p.m. to 4 p.m.) and 19 at midnight (10 p.m. to 12 p.m.).

MRs and distribution of gender of the care workers in the different shifts is shown in Table 4. Due to predominance of female care workers, the variables are defined as 1) female care workers only, 2) one male, and 3) two male care workers. In Table 4, MR is seen to occur in 8.3% of shifts with only women on duty. The proportion increased to 13.4% when one male care worker was present and to 17.4% when two male care workers were present.

Table 5 shows results from the binary logistic regression analysis. Note that evening shift (OR: 1.29), months (OR: 0.88) and gender (OR: 1.44) of care workers were significantly associated with MR both in the single variable analyses (A) and the multiple regression analyses (B). No associations were found between MR and staffing level, age, education, experience of care workers or change of shifts.

Discussion

The presence of male care workers was associated with increased use of MR. Our study did not explore the causal direction of this attribution. The patients typically restrained.
in this ward are self-harming young women with severe personality disorders rather than aggressive, psychotic men, making it unlikely that male care workers are extraordinarily called in, when MRs are performed. This matter is a relevant subject for further research. In Bilbao in Spain, they succeeded to reduce MRs among patients with personality disorders by implementation of practical guidelines with focus on a psychodynamic perspective [22]. In department Q1, a guideline is already used as well as weekly supervision and training of staff members.

The higher proportion of MR in the evening shifts (3 p.m.–11 p.m.) may be explained in many ways; Patient-related factors as well as organisational factors. Results from the regression analysis showed no significant association between MR and changes in shifts.

As a consequence of a high number of restraints in January and February, the incidence of MR was significantly higher at the beginning of the year. It should be noted that no higher numbers of restraints are seen in the months with summer holidays. This is interesting as one could assume that holidays among regular staff could affect the incidence of MR. The dark winter period and staying more inside may have a destabilising effect on some of the patients.

Staffing level was not found to be significant in the logistic regression analysis. Still, the distribution of MRs in relation to the number of care workers is significant as seen in Table 3. A possible explanation is that more care workers are recruited when the more severely ill patients are hospitalised at the department. According to the charge nurse at the ward, extra staff is called in, already in the same shift as the MR is carried out, when necessary. Besides, MR in one patient can create agitation and insecurity among other patients. Therefore, external care workers occasionally have to be called in, even though the regular staff in principle should cover the observation of the first restrained patient by themselves. Earlier studies investigating staffing level and MRs are conflicting. Betemps et al. [9] and Husum et al. [3] did not find an association between the use of restraints and staffing level, but Donat [7] and Smith et al. [13] did. Increasing the staff level without proper education will probably not lower MR.

Education, age and experience of care workers were not found to be associated with MR. Psychiatric nurses, psychiatric health care assistants and psychiatric nursing aids were distinguished, without showing any associations with MR.

As seen in Table 2, mean time for hospitalisation has decreased and the number of hospitalisations has increased since the study period. In the year 2014, MRs decreased in all departments in Q as well as in Q1, but in the year 2016 it

### Table 3. Distribution of mechanical restraint (MR) related to no. of care workers during day, evening and night shifts.

<table>
<thead>
<tr>
<th>No. of care workers on duty</th>
<th>Day shift</th>
<th>Evening shift</th>
<th>Night shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of shifts</td>
<td>Cases of MR</td>
<td>No. of shifts</td>
<td>Cases of MR</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>26</td>
<td>166</td>
</tr>
<tr>
<td>3</td>
<td>101</td>
<td>126</td>
<td>141</td>
</tr>
<tr>
<td>4</td>
<td>132</td>
<td>139</td>
<td>38</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
<td>58</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>25</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>366</td>
<td>372</td>
<td>360</td>
</tr>
</tbody>
</table>

Day shift: 7 a.m.–3 p.m., evening shift: 3 p.m.–11 p.m., night shift: 11 p.m.–7 a.m. In a two-sided Pearson’s chi-square test the distribution is significant ($p = .015$).

Includes all groups (all regular care workers, external care workers and medical students working as substitute care workers.).

The proportions were computed as “cases of MR” divided by “number of shifts”, without considering that some shifts contain more than one case of restraint.

### Table 4. Distribution of mechanical restraint (MR) in relation to gender of care workers.

<table>
<thead>
<tr>
<th>Variables</th>
<th>OR</th>
<th>95% CI</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female care workers only</td>
<td>672</td>
<td>56</td>
<td>8.3</td>
</tr>
<tr>
<td>One male care worker</td>
<td>404</td>
<td>54</td>
<td>13.4</td>
</tr>
<tr>
<td>Two male care workers</td>
<td>23</td>
<td>4</td>
<td>17.4</td>
</tr>
</tbody>
</table>

In a two-sided Pearson’s chi-square test the distribution is significant ($p = .017$).

### Table 5. Single variables and binary multiple regression analyses for mechanical restraint in a psychiatric ward.

<table>
<thead>
<tr>
<th>Variables</th>
<th>OR</th>
<th>95% CI</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single variable analyses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night shift</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Evening shift</td>
<td>1.8</td>
<td>1.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Day shift</td>
<td>0.9</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Month§</td>
<td>0.9</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Day of the week</td>
<td>0.9</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Change of shifts</td>
<td>0.1</td>
<td>0.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Staff total level</td>
<td>1.1</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Gender of care workers</td>
<td>1.6</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Age of psych. nurses</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Number of phca</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Number of pna</td>
<td>0.9</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Number of pna</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Age of phca</td>
<td>0.9</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Age of pna</td>
<td>1.1</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Multiple regression analyses</td>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Night shift</td>
<td>0.8</td>
<td>0.8</td>
<td>1.0</td>
</tr>
</tbody>
</table>

phca: psychiatric health care assistant; pna: psychiatric nursing aid.

*p < .05.

§Baseline month: January.

In SPSS version 20 a binary logistic regression analysis was used (enter method) (A). Hereafter the significant variables with $p < .2$ were entered in the model (B).
increased again. In Q1 even to a higher level than before. In the same period, the proportion of involuntary hospitalised patients increased from 10.6% to 15.5% in Q1. A higher number of patients with more severe personality disorders from the Central Denmark Region were referred to department Q1 in the year 2016. Besides two wards were closed at the hospital and a third ward added to department Q.

**Limitations**

The presented results may lead to ideas for interventions in future projects, but do not show a causality. Staff experience in our study was defined only as experience in the current ward, even though earlier work in other psychiatric wards necessarily adds abilities to the care worker. Data were collected from only one ward with a selected group of patients due to specialisation of the ward. Patients with personality disorders (e.g. Borderline personality disorders) may have more conflicting relationships to other patients, staff members and more self-harming actions, increasing the risk of restraints. Our results might therefore not be representative for patients with other diagnoses. The cases of MR were performed on a small number of patients. This makes the results less representative of psychiatric wards in general. To determine the actual number of care workers on duty was challenging, due to variations during a shift. Some psychiatric nurses did not officially count as present care workers because of supervising functions with no planned patient contact. Likewise, care workers sometimes had to leave the ward for break, if an emergency alarm went off in another ward or in order to accompany patients somewhere. Also, the working hours for external care workers and medical students did not always fit into the hours of the shifts. Hence they were added to the best fitting shift. Furthermore, extra staff can be called in after a case of MR, making it seem as if the number of staff was higher than it was when the MR actually took place. This fact might lead to an underestimation of the association between staffing level and MR. Furthermore, it should be noted, that all cases of MR were included in the study, even though some of them happened close to each other in time.

**Strengths**

All cases of MRs during the entire study period of 1 year were identified, due to thorough electronic registration. Detailed information about care workers was collected and connected to every single shift.

**Conclusions**

Positive associations were found between the incidence of MR, a higher number of male care workers on duty and evening shifts. No association was found between MR and staffing level. Relevant topics for further investigation are the influence of gender of staff on MR among patients with different diagnoses and ways to reduce MR in the evening shifts.

**Disclosure statement**

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

**References**


