Nordic Journal of Psychiatry

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Published online: 06 Sep 2017.

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Use of mechanical and pharmacological restraint over an eight-year period and its relation to clinical factors

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ABSTRACT

Background: Use of restraint and finding the balance between security and ethics is a continuous dilemma in clinical psychiatry. In daily clinic and in planning health-care service, knowledge on the characteristics of restraint situations is necessary to optimize its use and avoid abuse.

Methods: We describe characteristics in the use of pharmacological and mechanical restraint in psychiatric acute wards in a hospital in Middle Norway over an eight-year period. Data on all cases of mechanical and pharmacological restraint from 2004 to 2011 were retrospectively collected from handwritten protocols. Complementary information on the patients was obtained from the hospital patient administrative system.

Results: Restraint in acute wards was used on 13 persons per 100,000 inhabitants annually. The percentage of admitted patients exposed to restraint was 1.7%, with a mean of 4.5 cases per exposed patient. Frequency per 100 admitted patients varied from 3.7 (in 2007) to 10 (in 2009). The majority of restraint cases concerned male patients under 50 years and with substance-abuse, psychotic, or affective disorders. Significantly more coercive means were used during daytime compared to night and morning. There was a significant increase in pharmacological coercion during spring and mechanical coercion during summer.

Conclusions: Restraint was used on 1.7% of admitted patients, representing 13 per 100,000 inhabitants per year. Use of restraint was higher during certain periods of the day and was associated with the patient's diagnosis, age, gender, and legal status of hospitalization. There was a marked variation over the years.

Background and aim

Background

Any use of coercion raises ethical dilemmas and needs continuous surveillance. In clinical psychiatry, the balance between care, security, and abuse is challenging. Thus, there is an overall intention to limit the use of coercion to an absolute minimum, and there is national [1] as well as international [2–4] focus on how this can be achieved. Knowledge on factors influencing the use of coercion is mandatory to optimize the situation. Both clinicians and administrative decision makers need this information. There have been attempts to structure knowledge on factors influencing the occurrence and the duration of restraint [5,6]. However, there are deviations in reports between countries [7]. The need for a consensus on definitions has been discussed. A time frame of one year to avoid variation over the year and report on the number of incidents of restraint per 100,000 inhabitants in the hospital's catchment area are suggested [8,9].

National legislation regulates the use of different forms of coercion. The Norwegian health-care act §4–8 regulates the use of restraint [10]. Means that can be used include (a) mechanical restraint (straps on limbs and/or chest binding the patient to a bed or, in some cases, straps used to minimize movement during walk), (b) short-time isolation (seclusion), (c) pharmacological restraint in the form of short-acting medications such as benzodiazepines and antipsychotics *per os* or as injection (not to be confused with coerced psychopharmacological medication regulated by §4–4), and (d) short-lasting hold of the patient. The means of restraint can only be used in accordance with a decision by a senior clinical psychiatrist or clinical psychologist seeing the patient in the situation.

Restraint is often regarded as necessary in clinical psychiatry [11,12] and is mainly performed with care. Still, there are reports on unwanted effects such as prolonged admittance, pressure sores, psychological traumas, and even death [11,13–17]. Executing coercion and restraint is also stressful for the health-care personal. Patient's characteristics reported

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to influence the use of restraint vary but include the patient's diagnosis [11,18–21], younger age [20,22], immigrant background [20], and aggressive or self-harming behavior [23]. Reports on the effect of gender vary. Some studies report male gender to be a risk factor [20,22], others report a higher risk for female patients [19], and others find no effect of gender [20,24,25]. The time of day (peak in afternoon and early evening) and season (peak in autumn) are non-patient factors influencing the use of restraint [22]. Also, ward and staff factors such as education, work satisfaction, patient/staff ratio, systematic identification of patient crises, and action by separating severely ill patients from others may have an effect [5,26,27].

To evaluate the effect of attempts to reduce and optimize the use of restraint, a reliable registration of restraint is necessary. In Norway, electronic local and central registers are insufficient so far. Retrospective questionnaires also have been used [5]. A more direct way of registering the actual use of restraint is the examination of hand-written protocols at individual wards like Høyer and Drange [28,29] and Wynn [22] have done.

Aim of the study

We wanted to investigate factors associated with the use of mechanical and pharmacological restraints in a heterogeneous, stable acute ward population over an eight-year period. Also, we wanted to study the occurrence of mechanical and pharmacological restraints and the trends over a period of several years to reveal potential variations.

Materials and method

Setting

Data on medical and mechanical restraint according to the Norwegian health-care act §4–8 [10] as described in background were collected retrospectively from hand-written protocols for the period from 1st January 2004 to 31st December 2011. The included wards represented the only acute psychiatric inpatient care for adults in South-Trøndelag County in Middle Norway covering both rural and urban areas with a population of 290,000 inhabitants.

Study population

A total of 1468 cases of pharmacological and mechanical restraint were registered. Because of registration errors, ten cases were excluded, leaving 1458 cases of restraint in this study.

According to the tradition in the wards, isolation (seclusion) was not used as restraint, and holding was not registered until 2008. Thus, we have data only for mechanical and pharmacological restraint.

Measures

Information regarding all coercive episodes had been consecutively recorded in hand-written protocols at each ward by trained nurses and psychiatrists or psychologists. The date

and time of day were registered in these protocols. The patients' age, gender, diagnosis, and legal status of hospitalization (voluntarily or involuntarily admitted) at the time of restraint were collected from the hospital's electronic patient administration system (PAS).

Diagnoses were categorized in six groups based on diagnoses from ICD-10: organic mental disorders (F00–F09), use of psychoactive substances (F10–F19), schizophrenic spectrum disorders (F20–F29), mood disorders (F30–F39), personality disorders (F60–F69), and other diagnostic groups, including neurotic, stress-related, and somatoform disorders (F40–F49), behavior syndromes (F50–F59), mental retardation (F70–F79), disorders of psychological development (F80–F89), behavioral and emotional disorders usually occurring in childhood or adolescence (F90–F98), and unspecified mental disorders (F99).

The year was divided in four seasons: winter (21st December to 20th March), spring (21st March to 20th June), summer (21st June to 20th September), and fall (21st September to 20th December). The day was divided into four intervals: 00.01–06:00, 06:01–12:00, 12:01–18:00, and 18:01–00:00.

Analysis

Chi-square tests were used to compare the categorical data of patients being subjected to restraint (gender, legal referral status, and diagnosis) by type of restraint, and a simple comparison of age by type of restraint was done with the Mann–Whitney test. A cross tabulation was also performed to measure the frequency of the different restraints per season and per time interval and by admissions per year.

In the preliminary analysis, binary logistic regressions (OR 95% CI) were used to assess the correlation between the independent variables (gender, age, legal hospitalisation status, season, 24-h distribution, and diagnostic groups) by mechanical restraints versus pharmacological restraints. The diagnostic groups were categorized with schizophrenic spectrum disorders as a reference. Independent variables which correlated with the outcome in the binary analysis with $p < 0.100$ were included in the adjusted logistic regression analysis.

Ethics

In accordance with the regulations of the Health Research Act of 1st July 2008, the research project was presented to the regional committee for medical and health research ethics (REC). According to REC, there was no need for their consent, because the data were collected for quality-assurance reasons for the hospital. The Data Protection Office at Hospital and the Department Head approved the project (number 13/6804-2).

Results

Use of restraint

In the eight-year period under study, 324 persons were exposed to restraint covering a total of 1458 cases (mean 4.5

Table 1. Characteristics of patients being subjected to restraint.

	Total N	Mechanical n	Mechanical (%)	Pharmacological n	Pharmacological (%)	p Value
Patients	1458	863	(59.2)	595	(40.8)	
Age (years)	1457	862	(59.2)	595	(40.8)	
18–29	463	323	(69.8)	140	(30.2)	<0.001[a]
30–39	297	172	(57.9)	125	(42.1)	
40–49	370	253	(68.4)	117	(31.6)	
>50	327	114	(34.9)	213	(65.1)	
Gender	1458	863	(59.2)	595	(40.8)	
Female	614	387	(63.0)	227	(37.0)	0.011[b]
Male	844	476	(56.4)	368	(43.6)	
Referral status[c]	1433	850	(59.3)	583	(40.7)	
Voluntary	361	25129	(69.5)	110	(30.5)	<0.001[b]
Involuntary	1072	599	(55.9)	473	(44.1)	

[a]Mann–Whitney, nonparametric test.
[b]Pearson Chi-square.
[c]Missing information for 25 cases.
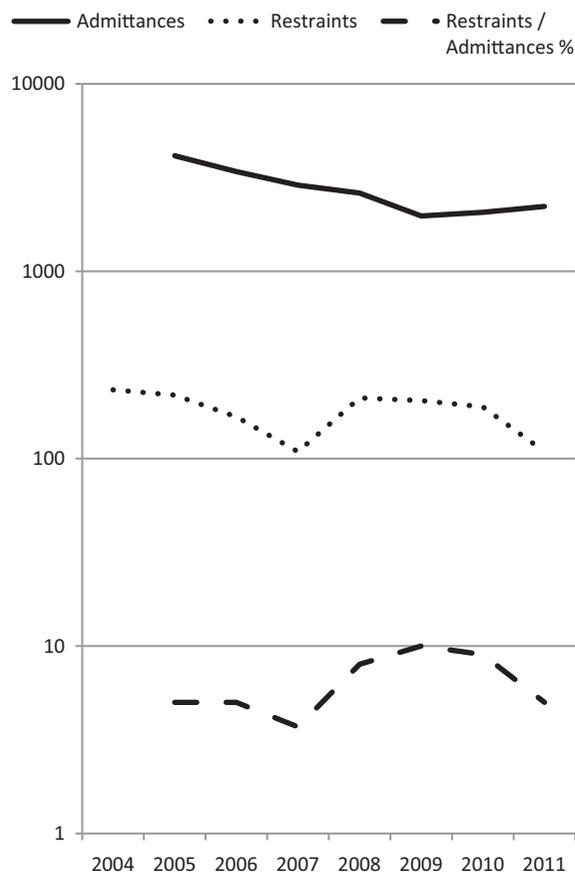
Figure 1. Total number of admittances, total number of restraints, and number of restraints in relation to number of admittances. Year on X-axis and logistic number scale on Y-axis.

Table 2. Characteristics of patients being subjected to restraint for the first time per individual N = 324.

	Total N	Mechanical n	Pharmacological n	p Value
Patents				
Age (years)[a]				0.008 F
18–29	101	46	55	
30–39	75	30	45	
40–49	66	22	44	
>50	82	18	64	
Gender				0.009 Q
Male	178	75	103	
Female	146	41	105	
Referral status[b]				0.066 D
Voluntary	87	38	49	
Involuntary	230	74	155	

[a]Mann–Whitney, nonparametric test.
[b]Missing information for 27 cases.
D = Chi-square 3.372.
F = Chi-square 11.765.
Q = Chi-square 6.891.

Patient characteristics associated with restraint

Gender
Significantly fewer females were subjected to restraint (p = 0.009, Table 2), although slightly more females than males were admitted to the acute wards (e.g. 58.5% females in the period 2005–2007).

Once subjected to restraint, males would significantly more often be subjected to mechanical restraints compared to females (p = 0.028, Table 3).

Legal status of hospitalization
Significantly more cases of restraint concerned patients who were involuntarily admitted (1072 patients with known hospitalisation status, 74.8%, p < 0.001, Table 1). However, for individual persons subjected to restraint (Table 2), the association to their legal status of hospitalization did not reach significance (p = 0.066). Actually, 361 (25.2%) cases of restraint were on voluntarily admitted patients. The data show that 29.5% of cases of mechanical restraints and 18% of cases of pharmacological restraints were on voluntarily admitted patients. Also, there was no correlation between legal status of hospitalization and type of restraint (mechanical versus pharmacological, Table 3). We had no information about the use of coercion according to legal status for 25 cases (1.7%).

cases per exposed patient) among the 19,283 patients admitted from the catchment area of 290,000 persons.

Annually, an average of 40 persons were exposed to restraint, corresponding to 1.7% of admitted patients. More than half (59.2%) of the cases of restraint were cases of mechanical restraint (see Table 1).

The use of restraint (in total as well as per admission) varied over the years (Figure 1) from 110 cases of restraint in 2883 admittances (3.8 cases per 100 admittances) in 2007 to a peak of 211 cases of restraint in 2638 admittances (8.0 cases per 100 admittances) in 2008.

Table 3. Unadjusted and adjusted logistic regression analysis (OR[a] and 95%CI[b]) of mechanical restraints versus pharmacological restraint at first registration per patient ($n = 316$).

	Unadjusted			Adjusted		
	OR	95% CI	*p* Value	OR	95% CI	*p* Value
Female gender (ref. male)	0.536	(0.336–0.856)	0.009	0.564	(0.338–0.941)	0.028
Age (pr years)	0.975	(0.960–0.991)	0.002	0.971	(0.971–0.989)	0.002
Involuntary admissions (ref. voluntary admission first time)	0.624	(0.376–1.034)	0.067	0.730	(0.413–1.290)	0.278
Diagnostic groups at admission first time						
Schizophrenic spectrum disorder (F20–F29)	Ref	1.00		Ref	1.00	0.006
Organic mental disorders (F00–F09)	1.929	(0.858–4.339)	0.112	4.004	(1.529–10.488)	0.005
Psychoactive abuse (F10–F19)	1.952	(0.957–3.984)	0.066	1.611	(0.749–3.467)	0.222
Mood disorders (F30–F39)	0.671	(0.336–7955)	0.271	0.815	(0.394–1.689)	0.583
Personality disorder (F60–F69)	2.678	(0.901–7.955)	0.076	2.451	(0.769–7.807)	0.129
Collective diagnostic group[c]	2.836	(1.373–5.856)	0.003	2.470	(1.137–5.368)	0.022
Adjusted R^{2d}					14.5%	

[a]OR = odds ratio.
[b]CI = confidence interval.
[c]Neurotic, stress-related, and somatoform disorders (F40–49), behavior syndromes (F50–59), mental retardation (F70–79), disorder of psychological development (F80–89), behavioral and emotional disorders usually occurring in childhood or adolescence (F90–98), and unspecified mental disorders (F99).
[d]Adjusted R^2 = Nagelkerke R^2.

Table 4. Pharmacological and mechanical restraint among diagnostic groups for first-time restraint per patient.

	Total (*N*)	Mechanical (*n*)	Pharmacological (*n*)	*p* Value[a]
Total (*n*)	316			0.003
Organic mental disorders (F00–F09)	31	14	17	
Psychoactive abuse (F10–F19)	44	20	24	
Schizophrenic spectrum disorder (F20–F29)	117	35	82	
Mood disorders (F30–F39)	67	15	52	
Personality disorder (F60–F69)	15	8	7	
Collective diagnostic group[b]	42	23	19	

Missing info in eight cases.
[a]Pearson chi-square.
[b]Neurotic, stress-related, and somatoform disorders (F40–49), behavior syndromes (F50–59), mental retardation (F70–79), disorders of psychological development (F80–89), behavioral and emotional disorders usually occurring in childhood or adolescence (F90–98), and unspecified mental disorders (F99).

Age

There was a significant effect of age on cases of restraint ($p < 0.001$, Table 1) and on individuals subjected to restraint ($p = 0.008$, Table 2). Age also was seen to affect the type of restraint chosen ($p = 0.002$, Table 3). Mechanical restraint was more often used for younger patients, and pharmacological restraint was more often chosen for older patients if restraint was used.

Diagnoses

Diagnostic groups are significantly differently represented in the group exposed to coercion ($p = 0.003$), with schizophrenic spectrum disorders (F20–29) and mood disorders (F30–39) being the most often represented (Table 4). Once subjected to restraint, the risk of experiencing mechanical rather than pharmacological restraint is significantly higher if the diagnoses are within the groups organic mental disorder ($p = 0.005$) and collective diagnostic group ($p = 0.022$), as can be seen in Table 3.

Non-patient factors

Seasonal and diurnal variation

The use and type of restraint varied significantly by seasonal time ($p = 0.043$, Table 5). During summer, mechanical restraint was used significantly more often than pharmacological restraint, whereas pharmacological restraint was used significantly more often than mechanical restraint during spring.

There was a significant diurnal variation ($p = 0.007$, Table 5). About 60% of all types of restraint were performed between 12:01 and 00:00. Both mechanical and pharmacological restraints were used more often in this period, and the difference was particularly large for mechanical restraints.

Discussion

Use of restraint

The data show that 1.7% of patients admitted to psychiatric acute wards (13 persons per 100,000 inhabitants per year) were subject to restraint in this eight-year period. Because the routines and culture for hospital admission vary a lot, the use of restraint per inhabitant probably is the best measure to use [9]. However, most studies report the percentage of admitted patients. In a Swiss study, restraint and seclusion were found to be used on 5.6% of admitted patients [18]. However, comparing these results is difficult because the number of inhabitants is not given in the Swiss study, and in our hospital, seclusion is not used. Others report the frequency of restraint among patients involuntarily admitted [23] or present studies based on wards not otherwise specified [28,29]. To our knowledge, there are no reliable numbers regarding the actual use of restraint per inhabitant. We found

Table 5. Seasonal and daytime variations in use of pharmacological and mechanical restraint.

	Total (N)	Mechanical		Pharmacological		p Value[a]
		n	(%)	n	(%)	
Season	1458	863	100	585	100	
Winter	328	190	22.0	138	23.2	0.043
Spring	383	208	24.1	175	29.4	
Summer	396	254	29.4	142	23.9	
Fall	351	211	24.4	140	23.5	
Time interval	1441	861	100	580	100	
00:01–06:00	288	163	18.9	125	21.6	0.007
06:01–12:00	262	136	15.8	126	21.7	
12:01–18:00	432	274	31.8	158	27.2	
18:01–00:00	459	288	33.4	171	29.5	

[a]Pearson Chi-square.

a marked variation over the years (from a minimum of 110 cases in 2007 to a maximum of 211 cases in 2008) in the same population, independently of potential attempts to reduce restraint in certain periods. This is in line with a Danish study for 2011–2013, which did not find any effect of attempts to reduce restraint at the wards [30]. There are reports on changes between separate periods (e.g. 1986 and 1990 [28] or 1990, 1991, 1994, 1998, and 2004 [21]) but not on the variation over several consecutive years. This variation was revealed as we analyzed data for several consecutive years in the same wards. It may indicate that analyzing the use of restraint for one specific period or comparing only two separate periods to analyze the effect of attempts to reduce restraint may be biased by the inherent inter-annual variation. The frequently found variation in use of coercion between different geographical regions or hospitals also should be viewed in this perspective. Probably, more studies on the absolute frequency of restraint should be performed over consecutive periods to map the use of restraint better.

Patient characteristics

As mentioned in the introduction, previous findings regarding the effect of gender show a large variation. We find significantly more males among those subjected to restraint (although slightly more females are admitted). Once subjected to restraint, males are subjected to mechanical restraint significantly more often. A study done on the staff's emotional reaction to violent behavior in psychiatric inpatients found that males and females provoked different reactions [31]. Thus, females may be perceived as less threatening than males and less susceptible to require restraint.

The Norwegian legislation allows the use of restraint independently of legal referral status. We investigated the association between legal referral status and restraint, and we did not find any significant correlation among those subjected to restraint. We have not adjusted for involuntary admission among the total patient population. A Danish study found a significant effect of being involuntarily admitted [30]. However, both studies illustrate that a substantial number of patients voluntarily admitted are subjected to restraint. Our data are very much in line with the findings for a Danish acute-ward population serving a catchment area of 250,000

registering the use of medical coercion. Here, 33% of those subjected to medical restraint were voluntarily admitted [32].

We find that younger patients are more often represented among those subjected to restraint and that younger age also influences the choice of restraint (mechanical *versus* pharmacological). This is in line with previous reports [20,22], although not everyone has observed this correlation [30]. We find that the diagnoses most frequently being represented among those subjected to restraint are schizophrenic spectrum disorders and mood disorders. This is in line with the recent Danish finding that the diagnoses Schizophrenia, transient psychoses, and mania made up 61% of the population subjected to pharmacological restraint [32].

Regarding diagnoses, once subjected to restraint, the use of mechanical restraint is significantly higher if the patients are diagnosed with organic mental disorder or are in the collective group, compared to the other diagnoses. Diagnostic groups have been found to influence the use of restraint, although with varying results. One reason for the variety of reports may be that different patient populations are studied and thus, so far, no clear conclusions on the overall effects of diagnoses can be reached. Our finding makes sense because these diagnostic groups include patients experiencing scary psychoses and thus acting aggressively in response to psychotic experiences. Simultaneously, these patients will potentially be more susceptible and vulnerable to experiencing the surroundings as threatening, unsafe, and dangerous. Thus, the psychological effect of restraint may be dramatic for this group.

Non-patient factors

We observed a seasonal variation with slightly more restraints in spring and summer. There were significantly more cases of pharmacological restraint in spring and more cases of mechanical restraint in summer.

This differs from Wynn et al. [22] who report a peak of restraint in autumn. However, a peak of cases of violence in spring (potentially leading to restraint) in the acute psychiatric wards in South-Trøndelag has been reported [33] as well as a peak of restraint in spring in Italy [34]. For mania, it is also established that there is an increase in spring [35], but we could not find any reports on seasonal variation in activity of non-affective psychoses. The finding of increased mechanical restraint in summer is partly in line with the findings of Paavola et al. [36] from a forensic psychiatric unit in Finland which showed an increase in restraint in summer and autumn. Medical explanations for increased restraint in summer are not obvious. Paavola et al. suggest effects of staff vacation and unexperienced substitute staff. This is a possibility in our study as well. This may be a target for interventions to reduce restraint. Worth noting, Wynn et al. [22] collected data in Tromsø, north of the polar circle, whereas Morken and Linaker [33] collected data in the middle of Norway, as we did, (just south of the polar circle but still far north on the Earth). The latitude would be similar for Finland. If one assumes that day light affects activity in psychiatric disorders as well as aggression and lifestyle (e.g.

vacation and substance use as well as different groups of staff at the wards), other places may have other findings. Still, the seasonal variation is a factor in preventive efforts in the wards at these latitudes.

Most use of coercion took place during daytime (12:01–18:00 and 18:01–00:00) in line with other reports [22]. This is expected because these are the hours during which most patients are awake, and this constitutes important information regarding preventive efforts in wards.

Study limitations and strengths

Our study has several limitations. It only addresses patients subjected to two (out of four possible) specific restraints. Also, we have not studied other kinds of coercive acts (coercive medication and nutrition, restrictions in social contact, coercive admission, etc.). Variations in diagnostic groups, age, gender, and comorbidity in the admitted population as a whole are not adjusted for. We only investigated the use of restraint in acute wards, leaving out information from high-security wards. Thus, we cannot draw conclusions on the use of restraint in different groups, all use of coercion, and so on. We did not register the duration of stay before use of restraint. Restraint has been shown to take place mainly during the first hours after admittance [30].

We only investigated factors available from hospital patient files. It was reported recently that extramural factors like no or poor outpatient psychiatric care before admittance as well as patients with poor compliance regarding psychotropic medications affected the use of restraint [30]. Such factors should be included in future studies. Also, we did not have data on clinical evaluation and motivation for use of restraint. Information on these issues may increase the knowledge in the field further. Because legislation and tradition differ significantly between countries, it is hard to generalize all findings across countries. Because all our data come from the same hospital and from the same catchment area, it might be hard to generalize the results to other patient populations.

One of the strengths of our study is that we have investigated the on-site hand-written clinical protocols continuously updated on the wards where the patients are and the coercion takes place to avoid deficient reports of coercion in electronic systems or recall bias in studies using retrospective questionnaires. Because there is a known variation during the year [9], we have covered the whole year and all seasons. Another important factor is that we have covered a period of several, consecutive years and not only reported 'point prevalence'. This matters because there is a marked inter-annual variation. The four wards in the study represented the only available inpatient acute psychiatric service for the whole catchment area of South-Trøndelag and thus the main use of restraint in the area. This allows us to calculate the frequency of restraint per 100,000 inhabitants in the catchment area, avoiding bias due to differences in the organization of psychiatric services as emphasized by Janssen et al. [9]. Thus, a representative image of the use of restraint in this area is shown. Also, this means that all social groups are represented.

Conclusions

A total of 13 persons per 100,000 inhabitants per year (1.7% of admitted patients) were subjected to restraint in the acute wards in the eight-year period from 2004 to2011. There was a marked inter-annual variation not otherwise explained that should be taken into account when analyzing use of restraint. The inter-annual variation seems to be independent of campaigns to reduce restraint, suggesting that other and maybe extramural/pre-hospital factors should be analyzed to explore the field further.

Among those subjected to restraint, we find significantly more males and younger persons, and in these cases, mechanical restraint is used more often than pharmacological restraint. The diagnostic groups including psychoses (schizophrenic spectrum disorder and affective disorders) were significantly more often found among those subjected to restraint. More restraint was performed during the time period 12:01–00:00 (afternoon and evening) and in spring and summer.

We suggest that studies on the use of restraint should take into account potential inter-annual variations with consecutive years included, as well as seasonal and diurnal variations. The significantly higher representation of patients with psychotic disorders among those subjected to restraint is explainable though worrisome because psychotic patients are particularly vulnerable and susceptible to experiencing the restraint as trauma. This phenomenon should be addressed. We suggest that the knowledge on the time of year and day with increased use of restraint is taken into account when running wards regarding presence, quantity, and competency of staff.

The frequency of cases of restraint (e.g. 40 patients per year) as well as per inhabitant (e.g. 13 per 100,000 inhabitants per year) is not very high. However, the experienced burden of restraint from patients as well as staff is high, and society is generally interested in this field. We suggest that qualitative studies in this field, examining the vast experiences, are also performed.

Disclosure statement

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