

Who is Subjected to Coercive Measures as a Psychiatric Inpatient? A Multi-Level Analysis

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Abstract: *Background:* For a reduction in the use of coercive interventions it will be necessary to identify patients at risk. The aim of this study was to explore the impact of basic patient characteristics at admission, history within 24 hours before admission, and living conditions on the risk of experiencing coercive measures, controlling for ward characteristics in a multi-level approach.

Methods: Patient characteristics of 3389 patients (1920 women) who had received inpatient treatment in 2007, data relating to coercive measures, and ward characteristics were extracted from the clinical basic documentation.

Results: Patients with aggressive behaviour in the 24 hours prior to admission had a three times higher risk of coercive measures compared to non-aggressive patients. Severity of illness increased the risk of coercion markedly. With each level of severity, the risk of coercion was doubled. Voluntariness of stay appeared to be the best protective factor against coercive measures. If a patient stayed voluntarily, this reduced the risk of coercion by more than two thirds. No impact was found for living conditions.

Conclusions: To identify patients at risk, it is most important to intensively monitor patients with aggressive behaviour prior to admission and patients with a greater severity of psychopathological symptoms.

Keywords: Coercion, multi-level-analysis, patient characteristics, patients at risk, prediction, psychiatric inpatients, ward characteristics.

INTRODUCTION

The first review on coercive interventions in 1994 stated that seclusion and mechanical restraint “can have deleterious physical and (more often) psychological effects on patients” [1]. Politics and clinical guidelines claim that coercive interventions have to be considered as interventions of last resort [2], though this claim is based on moral considerations rather than on empirical evidence regarding clinical and societal outcomes. Nevertheless, the variations in the use of seclusion or mechanical restraint point to powerful local effects which have been replicated over the years [1-9].

Manifold actions have been undertaken to reduce the use of coercive measures in the last 20 years. On a political level, claims have been pushed [10-15]. Several psychiatric associations have established guidelines [16, 17] and hospitals have trained staff in de-escalation [18, 19] and forced institutional changes (e.g. user involvement [20, 21] and crowding [22]). This progress was accompanied by mental health research that provided the basis for data assessment, benchmarking [7, 8], and evaluation of instruments (for overview, see [23, 24]).

For further reduction in the use of coercive interventions, it will be necessary to implement these guidelines into routine clinical care. In addition, it will be meaningful to identify patients at risk. However, up until now only few predictors of violent behaviour or self-directed aggression, which are mostly antecedent causes of coercive measures, and no predictors of coercive interventions themselves could consistently be found.

In research papers on predictors in this field, it is often discussed that studies are difficult to compare, legal premises [25] and even the definitions of coercive interventions differ significantly, different methodological approaches were undertaken, sample sizes were too small [9], and a reference population to the aggressive inpatients is difficult to define without being a source of bias itself [26].

Structural factors of wards, staff-related, patient-related, and treatment-related factors are considered to be associated with coercive measures [27]. Furthermore, environmental and interactional variables may be as important as the patient variables [26].

Whittington & Richter [28] argue that rather than focusing on patient variables, interactional effects between patient and staff behaviour should be considered in predicting violence in mental health settings. The same might be true for coercive interventions in the same settings.

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Table 1. Patients with Comorbid ICD-10 FX.xx Diagnosis

Comorbidity (N = 3389)									
F0	F1	F2	F3	F4	F5	F6	F7	F8	F9
310 (9.1%)	575 (17.0%)	232 (6.8%)	382 (11.3%)	411 (12.1%)	51 (1.5%)	334 (9.9%)	147 (4.3%)	17 (0.5%)	24 (0.7%)

In a recent study, using a multi-level approach and taking both, ward and patient characteristics into account, no predictors of coercive measures other than overactivity and aggressiveness could be identified, although substantial between-ward variance in the use of coercive measures was observed [9].

The aim of this study was to explore the impact of basic patient characteristics at admission, history within 24 hours before admission, and living conditions on the risk of experiencing coercive measures, controlling for ward characteristics in a multi-level approach.

MATERIALS AND METHODOLOGY

Data Acquisition

Patient characteristics, data relating to coercive measures, and characteristics of the psychiatric wards were extracted from an extensive data base which contains routinely collected data from the clinical basic documentation of the Centre for Psychiatry Suedwuerttemberg [29]. This is a psychiatric organisation providing inpatient psychiatric care at five sites, serving a catchment area of about 1.2 million inhabitants in South West Germany. The basic documentation is part of the electronic charts. It contains comprehensive data about the patient, therapeutic procedures, and a variety of adverse events such as unauthorised leave, medication side effects, or use of coercive measures. In particular, data on coercive measures are considered as highly accurate due to the legal obligations of documentation. Generally, the recorded electronic data have been found to be sufficiently valid and reliable with about 5% false entries [30].

Sample

The sample consisted of N = 3389 patients (1920 women, 56.7%) who had received inpatient treatment in 2007. The mean age was 52.0 years (sd = 19.9). Five hundred and seventy-six patients (17.0%) were involuntarily committed for at least a part of their inpatient stay. Inclusion criteria were an ICD-10 main diagnosis of F0.xx: Organic, including symptomatic, mental disorders (N = 512, 15.1%), F1.xx: Mental and behavioural disorders due to psychoactive substance use (N = 226, 6.7%), F2.xx: Schizophrenia, schizotypal, and delusional disorders (N = 1010, 29.8%), F3.xx: Mood [affective] disorders (N = 981, 28.9%), F4.xx: Neurotic, stress-related, and somatoform disorders (N = 459, 13.5%), or F6.xx: Disorders of adult personality and behaviour (N = 201, 5.9%) as first diagnosis. Due to the small number (12 patients) patients with an ICD-10 F5.xx diagnosis were excluded. A comorbid ICD-10 FX.xx diagnosis was present in 1862 patients (54.9%). The comorbidities are displayed in Table 1. For patients with re-admissions, only the

first stay terminated in 2007 was included so that for each patient only one admission was analysed. Nearly the complete sample was white Caucasian. Two thousand eight hundred and forty-three (83.9%) patients were German; the others were from outside the European Community (216 patients, 6.4%; among them 110 Turkish, 3.2%) and from the European Community (102 patients, 3.0%). For 228 patients (6.7%), no data on nationality existed.

Definition of Interventions

Seclusion was defined as bringing the patient into a locked room where they are alone and able to move freely but unable to leave, due to the locked door [25]. During seclusion, patients were observed every 10-15 minutes through a window in the door of the seclusion room.

Mechanical restraint referred to the use of belts to fix the patient to the bed [25]. According to internal hospital guidelines, patients had to be constantly and personally monitored during mechanical restraint. Involuntary medication was defined as the application of medication by force with "hands on" [25]. All types of psychological pressure were not included.

Statistical Analysis

Independent variables on ward level were the total number of admissions for each ward in 2007 and the total number of incidents of aggressive behaviour for each ward in 2007. On patient level, independent variables were sex, age, German citizenship (yes/no), diagnosis of schizophrenia (yes/no), number of previous psychiatric treatments (none, one, two to five, more than five), voluntary stay (yes/no), guardianship (yes/no), married (yes/no), unemployed or retired (yes/no), living independently (yes/no), patient had stopped anti-psychotic medication prior to admission without medical advice (yes/no), aggressive behaviour within 24 hours prior to admission (yes/no), self-threatening or self-damaging behaviour within 24 hours prior to admission (yes/no), suicide attempt or threat of suicide within 24 hours prior to admission (yes/no), substance abuse within 24 hours prior to admission (yes/no), Clinical Global Impression Scale Score (CGI) at admission, and a comorbid psychoactive substance use (F1.xx without F17.xx: Mental and behavioural disorders due to use of tobacco). Dependent variables were at least one coercive measure (yes/no), at least one mechanical restraint (yes/no), at least one seclusion (yes/no), at least one involuntary medication (yes/no), and the total number of coercive measures. As data were clustered (patients within wards) and independent variables for both levels were included, hierarchical linear models were used for estimation. Binomial models were employed for the dichotomous dependent variables and Poisson-models with variable exposure were fitted for the number of coercive measures.

Table 2. Type and Mean Number of Coercive Measures for the Diagnostic Groups

Diagnosis	Any Coercive Measure	Mechanical Restraint	Seclusion	Involuntary Medication	Mean Number of Coercive Measures (sd)
F0 (n=512)	150 (29.3%)	131 (25.6%)	74 (14.5%)	7 (1.4%)	2,6 (7,9)
F1 (n=226)	15 (6.6%)	13 (5.8%)	7 (3.1%)	2 (0.9%)	0,2 (0,8)
F2 (n=1010)	129 (12.8%)	71 (7.0%)	75 (7.4%)	33 (3.3%)	0,8 (7,2)
F3 (981)	32 (3.3%)	22 (2.2%)	20 (2.0%)	11 (1.1%)	0,1 (1,3)
F4 (459)	22 (4.8%)	13 (2.8%)	11 (2.4%)	0 (0.0%)	0,2 (2,0)
F6 (201)	14 (7.0%)	8 (4.0%)	8 (4.0%)	2 (1.0%)	0,5 (3,1)

To assess the explanatory power of the independent variables, different models were formulated for each dependent variable. Model 1 contained all ward-level and patient-level variables except for "patient stopped anti-psychotic medication without medical advice". This item was added in Model 2. Because this information applies only to patients with recommended anti-psychotic medication, the sample of this model is consequently restricted to patients with a diagnosis of a schizophrenic disorder or bipolar disorder (psychotic subgroup, $n = 1133$, 33.5%). All variables were entered into the models simultaneously. As aggressive behaviour prior to admission and staying in the hospital involuntarily were suspected to interact, in both, Model 1 and Model 2, only the interaction terms of these two variables were entered.

Analyses were carried out using statistica version 8.0 and HLM version 6.

RESULTS

In the sample, 362 (10.7%) patients experienced at least one coercive measure. Two hundred and fifty-eight patients (7.6%) experienced mechanical restraint, 195 patients (5.8%) experienced seclusion, and 55 patients experienced involuntary medication (1.6%). Both mechanical restraint and seclusion were experienced by 143 patients (4.2%), and 27 patients were subjected to the combination of mechanical restraint, seclusion, and involuntary medication. In addition, 12.5% of the male patients and 9.3% of the female patients were subjected to at least one coercive measure, and 10.7% of the patients with German citizenship were subjected to coercion. In patients with any other citizenship, 10.4% were subjected to coercive measures. Of those patients who experienced coercive measures, 150 (41.4%) had an F0.xx diagnosis, 15 (4.1%) had an F1.xx diagnosis, 129 (35.6%) had an F2.xx diagnosis, 32 (8.8%) had an F3.xx diagnosis, 22 (6.1%) had an F4.xx diagnosis, and 14 (3.9%) had an F6.xx diagnosis. Of those 1113 patients with recommended anti-psychotic medication (i.e. patients with an F2.xx or an F31.xx diagnosis), 102 patients (9.0%) had stopped anti-psychotic medication prior to admission without medical

advice. Of those patients who had stopped anti-psychotic medication without medical advice, 24 patients (20.6%) experienced coercive measures. The type of coercive measure and mean number of coercive measures in each diagnostic category is displayed in Table 2.

RESULTS FOR THE TOTAL SAMPLE (TABLE 3)

Risk of Any Coercive Measure

Ward-Level

On ward-level, the total number of incidents of aggressive behaviour showed a significant positive correlation with the risk of coercion for the individual patient.

Patient-Level

The best predictor of any coercive measure on patient-level for the total sample was the interaction between an involuntary stay and aggressive behaviour within 24 hours prior to admission. Severity of illness (CGI) at admission was highly positively associated with the risk of coercion. Also, self-threatening or self-damaging behaviour within 24 hours prior to admission resulted in a higher risk of a coercive measure. The length of hospital stay was associated with an increased risk of a coercive measure. Patients who had attempted suicide or had threatened with suicide within 24 hours prior to admission had a lower risk of being subjected to coercion.

Risk of Mechanical Restraint

Ward-Level

On ward-level, the total number of incidents of aggressive behaviour was a significant predictor of mechanical restraint.

Patient-Level

Again, the interaction between involuntariness of hospital stay and aggressive behaviour prior to admission was the best predictor for the risk of being mechanically restrained. Further variables significantly associated with a higher risk

Table 3. Results of the Multi-Level Regressions for the Total Sample (n = 3389)

	Risk of a Coercive Measure	Risk of Mechanical Restraint	Risk of Seclusion	Risk of Involuntary Medication	Total Number of Coercive Measures
Variable	Odds ratio (95%-CI)	Odds ratio (95%-CI)	Odds ratio (95%-CI)	Odds ratio (95%-CI)	Event-rate ratio (95%-CI)
intercept	0.00*** (0.00, 0.003)	0.00*** (0.00, 0.01)	0.00*** (0.00, 0.002)	0.00*** (0.00, 0.002)	0.00*** (0.00, 0.00)
<i>ward-level</i>					
total number of admissions	1.00 (1.00, 1.01)	1.00 (0.99, 1.01)	1.00 (1.00, 1.01)	1.00 (0.99, 1.01)	1.01* (1.00, 1.01)
total number of incidents of aggressive behaviour	1.05** (1.02, 1.08)	1.05** (1.03, 1.08)	1.07** (1.03, 1.12)	1.03 (0.99, 1.07)	1.07* (1.01, 1.13)
<i>patient-level</i>					
gender: female	0.79 (0.57, 1.12)	0.68* (0.50, 0.94)	0.81 (0.59, 1.11)	1.02 (0.50, 2.07)	0.63* (0.41, 0.97)
age	1.01 (0.99, 1.02)	1.02 (1.00, 1.04)	1.01 (0.99, 1.03)	0.98 (0.95, 1.01)	1.00 (0.98, 1.03)
German citizenship	0.75 (0.54, 1.05)	0.56* (0.33, 0.94)	0.68 (0.42, 1.11)	1.17 (0.56, 2.45)	1.12 (0.69, 1.82)
diagnosis: Schizophrenia	0.74 (0.50, 1.09)	0.59* (0.39, 0.90)	0.64 (0.38, 1.07)	0.76 (0.38, 1.52)	0.83 (0.51, 1.36)
length of stay	1.01** (1.00, 1.01)	1.01* (1.00, 1.01)	1.01* (1.00, 1.01)	1.00 (0.99, 1.01)	excluded
number of previous psychiatric admissions	1.00 (0.85, 1.18)	0.94 (0.83, 1.07)	1.07 (0.86, 1.32)	1.52* (1.04, 2.22)	0.88 (0.72, 1.09)
guardianship	1.04 (0.53, 2.03)	1.06 (0.47, 2.39)	1.24 (0.55, 2.80)	0.63 (0.22, 1.79)	1.91 (0.54, 6.72)
Unmarried	1.07 (0.77, 1.50)	1.01 (0.72, 1.41)	1.25 (0.80, 1.95)	0.63 (0.32, 1.28)	1.18 (0.72, 1.94)
unemployed or retired	0.79 (0.51, 1.23)	0.73 (0.46, 1.16)	0.85 (0.42, 1.72)	0.84 (0.44, 1.60)	0.97 (0.42, 2.27)
living independently	0.84 (0.66, 1.08)	0.68** (0.54, 0.84)	0.83 (0.60, 1.16)	1.19 (0.68, 2.06)	0.78 (0.47, 1.28)
self-threatening or self-damaging behaviour within 24 hours prior to admission	1.46** (1.10, 1.93)	1.24 (0.93, 1.65)	1.68** (1.21, 2.35)	1.38 (0.83, 2.29)	1.29 (0.71, 2.35)
suicide attempt or suicide threat within 24 hours prior to admission	0.53** (0.36, 0.78)	0.52* (0.31, 0.88)	0.66 (0.40, 1.11)	0.92 (0.45, 1.90)	0.69 (0.44, 1.09)
substance abuse within 24 hours prior to admission	0.84 (0.47, 1.53)	0.66 (0.36, 1.21)	0.72 (0.36, 1.46)	0.30* (0.12, 0.75)	0.40*** (0.22, 0.73)
CGI at admission	2.08*** (1.81, 2.40)	2.28*** (1.87, 2.77)	1.91*** (1.57, 2.33)	2.86*** (1.86, 4.40)	2.18*** (1.85, 2.56)

Table 3. contd...

	Risk of a Coercive Measure	Risk of Mechanical Restraint	Risk of Seclusion	Risk of Involuntary Medication	Total Number of Coercive Measures
aggressive behaviour within 24 hours prior to admission and voluntary stay ⁽¹⁾	3.26*** (1.83, 5.82)	2.71** (1.5, 4.70)	2.18* (1.01, 4.71)	12.09*** (4.32, 33.81)	1.76* (1.01, 3.07)
no aggressive behaviour within 24 hours prior to admission and involuntary stay ⁽¹⁾	3.95*** (2.10, 7.41)	3.21*** (1.63, 6.34)	3.45** (1.75, 6.84)	12.80*** (4.57, 35.87)	1.57 (0.84, 2.96)
aggressive behaviour within 24 hours prior to admission and involuntary stay ⁽¹⁾	14.95*** (8.88, 25.19)	8.48*** (4.37, 16.45)	13.18*** (7.31, 23.76)	30.63*** (11.74, 79.92)	2.67** (1.37, 5.20)
comorbidity substance abuse ⁽²⁾	0.76 (0.56; 1.03)	0.98 (0.72, 1.33)	0.67 (0.38, 1.19)	0.60 (0.16, 2.24)	0.54 (0.28, 1.07)

⁽¹⁾ reference category: no aggressive behaviour within 24 hours prior to admission and involuntary stay

⁽²⁾ smoking excluded

***p < .001, **p < .01, *p < .05

of restraint were a greater severity of illness (CGI) and a longer hospital stay. A reduced risk of being restrained was found in patients who attempted suicide or threatened with suicide before admission, in patients with German citizenship, in patients with a diagnosis of schizophrenia, in women, and in patients who were living independently.

Risk of Seclusion

Ward-Level

There was a positive correlation between the total number of aggressive incidents on a ward and the risk of seclusion for the individual patient.

Patient-Level

The best predictor of seclusion on patient-level was the interaction between involuntariness of stay and aggressive behaviour within 24 hours prior to admission. The risk of seclusion increased with the severity of illness and the length of hospital stay. Also, patients who showed self-threatening or self-damaging behaviour within 24 hours prior to admission were more likely to be secluded.

Risk of Involuntary Medication

Ward-Level

On ward level, neither the total number of admissions nor the number of incidents of aggressive behaviour was a significant predictor.

Patient-Level

Patients who stayed involuntarily and showed aggressive behaviour within 24 hours prior to admission had the greatest risk of involuntary medication. Patients with a higher severity of illness also had an increased risk of involuntary medication.

Number of Coercive Measures

Ward-Level

On ward level, the number of coercive measures was positively correlated with both the total number of admissions and the number of aggressive incidents.

Patient-Level

Aggressive behaviour 24 hours prior to admission in combination with an involuntary hospital stay increased the number of coercive measures. The number of coercive measures increased with the severity of illness. A reduced number of coercive measures were found in women and in patients with substance abuse prior to admission.

RESULTS FOR THE PSYCHOTIC SUBGROUP (TABLE 4)

Risk of Any Coercive Measure

Ward-Level

On ward level, neither the total number of admissions nor the number of incidents of aggressive behaviour was a significant predictor.

Patient-Level

The interaction between aggressive behaviour within 24 hours prior to admission and an involuntary stay was the best predictor of a coercive measure in patients with schizophrenia or a bipolar disorder. Severity of illness was positively associated with the risk of coercion in the psychotic subgroup, as well as the length of the hospital stay. Psychotic patients who had attempted suicide or had threatened with suicide within 24 hours prior to admission had a lower risk of being subjected to coercion. A lower risk was also found in patients with German citizenship.

Risk of Mechanical Restraint

Ward-Level

For the psychotic subgroup, the individual risk of restraint increased with each additional aggressive incident on a ward.

Patient-Level

For psychotic patients who stayed involuntarily and who had shown aggressive behaviour within 24 hours prior to admission, the risk of restraint was highest. For patients from the psychotic subgroup, the risk of being restrained increased

with the severity of illness as well as with age. For patients with German citizenship, the risk of restraint was reduced. Patients with a diagnosis of schizophrenia had a lower risk of restraint than patients with bipolar disorder. For patients who lived independently, the risk of mechanical restraint was also reduced.

Risk of Seclusion

Ward-Level

The total number of aggressive incidents on a ward and the individual risk of seclusion were positively correlated in the psychotic subgroup.

Patient-Level

The best predictors of seclusion on patient-level in the psychotic subgroup were aggressive behaviour during 24 hours prior to admission and involuntariness of hospital stay. With increasing severity of illness, psychotic patients had a higher risk of seclusion. Length of stay was also positively related to the risk of seclusion. Compared to patients with a diagnosis of bipolar disorder, patients with a diagnosis of schizophrenia were less likely to be secluded.

Risk of Involuntary Medication

Ward-Level

On ward level, the number of aggressive incidents was a significant predictor for involuntary medication.

Patient-Level

In the psychotic subgroup, a much higher risk of involuntary medication was found for patients who were admitted involuntarily and who had shown aggressive behaviour within 24 hours prior to admission. Also, psychotic patients with a greater severity of illness had an increased risk of involuntary medication. For patients in the psychotic subgroup, the risk of involuntary medication also increased with the number of previous psychiatric admissions.

Number of Coercive Measures

Ward-Level

On ward level, neither the total number of admissions nor the number of aggressive incidents was a significant predictor of the number of coercive measures.

Patient-level

Aggressive behaviour prior to admission in combination with an involuntary hospital stay led to more coercive measures. The number of coercive measures increased for patients in the psychotic subgroup with severity of illness. Patients who had stopped their anti-psychotic medication without medical advice experienced less coercive measures. Substance abuse prior to admission reduced the number of coercive measures.

DISCUSSION

This study supports the discussion on prevention of coercive interventions with empirical data concerning the predictors. Predictors of coercive interventions could be analysed regarding ward characteristics, patient characteristics at ad-

mission, history within 24 hours before admission, and living conditions.

We found a high rate of coercive measures in the organic mental disorder (F0) and the schizophrenia (F2) diagnostic group, and lower rates in the other diagnostic groups.

Although substance abuse and mania are generally considered to be two of the most important risk factors of aggressiveness and violence, these data are well in line with previous studies, including the hospitals investigated in this study [31]. At first glance, the low prevalence of coercive measures among people with substance use disorders (F1) and affective disorders including mania (F3) may seem striking. However, under conditions of psychiatric hospital treatment in Germany, a considerable proportion of admissions of patients with addictive disorders are planned on a voluntary basis and most of them are not intoxicated at admission. Thus, the rate of involuntary admissions and coercive measures is low in relation to the total number of admissions. Patients with mania according to ICD-10 are subsumed in the category "affective disorders", together with depressive disorders. The latter are exposed to coercive measures to only a small extent. Actually, patients with mania had the highest risk of receiving any type of coercive measure (Table 4). Many patients with suicidal behaviour, frequently with a comorbid diagnosis of a personality disorder, receive a primary diagnosis of adjustment disorder (F4) and some of them require coercive measures due to their behaviour.

Aggressive behaviour in the 24 hours prior to admission, in combination with an involuntary admission, turned out to be the best predictor for the use of coercion, regardless of the type of coercive measure applied. Compared to non-aggressive patients, aggressive patients had a higher risk of being exposed to coercive measures. A clear effect was also found for the voluntariness of the hospital stay. Voluntariness of stay appeared to be the best protective factor against coercive measures. Severity of illness increased the risk of coercion markedly. Taken together, these results are in accord with the findings of Husum *et al.* [9], as aggressive behaviour prior to admission and severity of illness seemed to influence both the risk of coercive measures as well as the rate of coercive measures. No conclusive evidence was found for the impact of living conditions.

There was no evidence that the variable "patient stopped anti-psychotic medication without medical advice" significantly increased the risk of coercion. Those patients even had a lower number of coercive incidents on average, indicating that re-establishing the previous treatment may limit crisis situations rather quickly. An indirect effect mediated by aggressive behaviour before admission seems rather unlikely. Among those patients who had stopped their anti-psychotic medication, 31% had shown aggressive behaviour within 24 hours prior to admission. Furthermore, of those patients who both had stopped medication and had shown aggressive behaviour, only 41% experienced a coercive measure. However, it should be recognised that we only assessed this item dichotomously. As no data on dose-reduction had been available, our results may be positively biased and must be interpreted with caution.

Table 4. Results of the Multi-Level Regressions for the Psychotic Subgroup (n = 1133)

	Risk of a Coercive Measure	Risk of Mechanical Restraint	Risk of Seclusion	Risk of Involuntary Medication	Total Number of Coercive Measures
Variable	Odds ratio (95%-CI)	Odds ratio (95%-CI)	Odds ratio (95%-CI)	Odds ratio (95%-CI)	Event-rate ratio (95%-CI)
Intercept	0.00*** (0.00, 0.02)	0.00*** (0.00, 0.02)	0.00*** (0.00, 0.004)	0.00** (0.00, 0.03)	0.00*** (0.00, 0.01)
<i>ward-level</i>					
total number of admissions	1.00 (1.00, 1.01)	1.00 (0.99, 1.00)	1.00 (0.99, 1.01)	1.00 (0.99, 1.00)	1.01 (1.00, 1.02)
total number of incidents of aggressive behaviour	1.03 (1.00, 1.06)	1.04** (1.02, 1.06)	1.06* (1.01, 1.11)	1.04* (1.00, 1.09)	1.06 (1.00, 1.12)
<i>patient-level</i>					
gender: female	1.04 (0.67, 1.63)	0.81 (0.49, 1.33)	1.07 (0.79, 1.44)	0.76 (0.34, 1.72)	0.95 (0.61, 1.47)
Age	1.00 (0.98, 1.02)	1.02* (1.00, 1.05)	1.02 (0.99, 1.04)	0.97 (0.94, 1.01)	0.99 (0.93, 1.05)
German citizenship	0.49** (0.32, 0.77)	0.29*** (0.17, 0.50)	0.51 (0.25, 1.07)	0.88 (0.31, 2.50)	0.94 (0.38, 2.32)
diagnosis: Schizophrenia ⁽²⁾	0.45 (0.19, 1.06)	0.35* (0.13, 0.93)	0.35* (0.13, 0.96)	0.35 (0.11, 1.15)	0.59 (0.21, 1.62)
length of stay	1.01** (1.00, 1.01)	1.01 (1.00, 1.01)	1.01* (1.00, 1.01)	1.00 (0.99, 1.01)	excluded
number of previous psychiatric treatments	1.04 (0.80, 1.33)	0.84 (0.63, 1.11)	1.09 (0.76, 1.54)	1.78* (1.11, 2.85)	0.88 (0.64, 1.21)
guardianship	0.73 (0.46, 1.16)	0.92 (0.42, 2.03)	0.65 (0.38, 1.12)	0.72 (0.27, 1.87)	2.04 (0.68, 6.12)
Unmarried	1.22 (0.78, 1.90)	1.04 (0.74, 1.47)	1.75 (0.87, 3.51)	0.62 (0.25, 1.53)	1.40 (0.62, 3.13)
unemployed or retired	0.71 (0.47, 1.07)	0.89 (0.49, 1.63)	1.01 (0.50, 2.05)	0.81 (0.34, 1.96)	0.94 (0.39, 2.28)
living independently	0.74 (0.49, 1.12)	0.51** (0.34, 0.77)	0.92 (0.55, 1.57)	1.44 (0.52, 3.97)	0.94 (0.47, 1.94)
patient had stopped anti-psychotic medication without medical advice	0.93 (0.47, 1.83)	0.83 (0.29, 2.48)	0.89 (0.41, 1.93)	0.95 (0.34, 2.66)	0.17** (0.05, 0.60)
self-threatening or self-damaging behaviour within 24 hours prior to admission	1.47 (0.79, 2.76)	0.91 (0.45, 1.84)	1.19 (0.62, 2.27)	1.29 (0.51, 3.22)	1.03 (0.58, 1.83)
suicide attempt or suicide threat within 24 hours prior to admission	0.41* (0.20, 0.84)	0.31* (0.10, 0.99)	0.61 (0.27, 1.37)	1.01 (0.22, 4.69)	0.24 (0.05, 1.27)
substance abuse within 24 hours prior to admission	1.09 (0.44, 2.67)	0.37* (0.16, 0.85)	1.02 (0.44, 2.37)	0.00 (0.00, 1.00)	0.38** (0.19, 0.79)
CGI at admission	1.93*** (1.43, 2.58)	2.70*** (1.94, 3.73)	2.05*** (1.38, 3.05)	2.85** (1.55, 5.23)	1.59* (1.04, 2.43)

Table 4. contd...

	Risk of a Coercive Measure	Risk of Mechanical Restraint	Risk of Seclusion	Risk of Involuntary Medication	Total Number of Coercive Measures
aggressive behaviour within 24 hours prior to admission and voluntary stay ⁽¹⁾	4.11*** (1.91, 8.81)	3.61*** (1.49, 8.77)	2.51* (1.06, 5.95)	5.76* (1.49, 22.29)	1.79 (0.57, 5.47)
no aggressive behaviour within 24 hours prior to admission and involuntary stay ⁽¹⁾	3.34* (1.34, 8.29)	2.92* (1.10, 7.74)	2.58*** (0.84, 7.94)	7.02*** (2.29, 21.50)	2.77 (0.73, 10.50)
aggressive behaviour within 24 hours prior to admission and involuntary stay ⁽¹⁾	16.59*** (7.97, 34.52)	8.57*** (3.27, 22.44)	10.03 (4.96, 20.23)	19.97*** (6.57, 60.72)	4.66*** (2.01, 10.82)
comorbidity substance abuse ⁽³⁾	0.70 (0.40, 1.23)	0.87 (0.44, 1.75)	0.61 (0.29, 1.29)	0.53 (0.13, 2.23)	0.70 (0.26, 1.94)

⁽¹⁾ reference category: no aggressive behaviour within 24 hours prior to admission and involuntary stay

⁽²⁾ reference category: bipolar disorder

⁽³⁾ smoking excluded

***p < .001, **p < .01, *p < .05

No effect on the risk of coercion was found for a comorbid diagnosis of substance abuse or substance abuse 24 hours prior to admission. The latter even reduced the risk for coercive interventions by number. This is well in accordance with clinical experience: intoxicated patients may frequently show aggressive behaviour requiring coercive interventions, but after some hours of detoxification they calm down and there is no need to repeat further coercive measures during an inpatient stay.

While the proportion of patients who were subjected to a coercive measure did not differ with respect to citizenship, after controlling for the other variables, non-German patients had a higher risk of coercion. This also applied for the psychotic subgroup. This may be due to cultural strangeness and language difficulties. A lack of oral proficiency can be assumed for many of the non-German patients.

Comparing this study with the study of Husum *et al.* [9], the data presented in this article are comparable regarding the sample size. However Husum *et al.* included only the involuntarily admitted patients in the analyses of the predictors of coercive interventions, which may lead to bias. In our sample, 34% of the involuntarily admitted patients experienced at least one coercive measure in contrast to only 6% of the voluntarily admitted patients.

As voluntariness of admission reduces the risk of coercive interventions, further efforts to reduce the threshold of psychiatric inpatient-treatment should be undertaken. Actions could comprehend a so-called dialogue (i.e. communication between patients, relatives, and health care professionals), a close cooperation between out and inpatient treatment, and establishing a continuous treatment forging close personal relationships with the staff to provide confidence.

Initially, the reduced risk of coercion for patients who threatened with suicide or attempted suicide within 24 hours prior to admission seems counterintuitive. However this

might be explained by the fact that the use of coercive measures in suicidal or self-harming patients is considered widely inappropriate. Exceptions occur if the behaviour cannot be stopped by staff interventions or continuous surveillance.

The sample size was a strong point of this study. A large sample size allows precise statistical analyses, such as the presented multi-level approach. Further strengths of the study lie in the inclusion of different settings of psychiatric care which represent the reality of mental health care of a whole region. Furthermore, while many studies and meta-analyses are available for the predictors of violence, so far only a scarce amount of literature exists concerning the predictors of coercion. In addition, we could investigate a comprehensive set of predictors for different forms of coercion. The basic patient documentation which had been established five years before provided a structured and consistent evaluation of each single stay. Inter-rater effects were minimised. In an independent evaluation [30], the data were more than sufficiently valid and reliable.

Unfortunately, detailed information on the type of aggression (assault, threatening behaviour, damage to property, self-harm) prior to admission was not available. Quantifying type and extent of aggression would have been useful, but such an item is not yet included in the basic documentation and therefore could not be considered as an independent variable. A differentiated rating of the psychopathological symptoms of each patient by trained interviewers would have been preferable from a methodological point of view, but is not feasible for several thousand patients under routine conditions. A shortcoming of the study is that mainly all diagnoses were analysed together. A possible difference between diagnostic subgroups was only tested with respect to patients with schizophrenia vs. all other diagnoses and vs. bipolar disorder. Only a subgroup of patients with a F2 or F3.1 diagnosis (schizophrenia or bipolar disorder) was analysed separately in order to assess the effect of stopping recommended medication without consultation. This approach

may blur differences between diagnostic groups. In our study, ward characteristics were limited to only two variables. This was due to the use of basic documentation data without any further data acquisition. As the basic documentation does not contain any items on ward characteristics, only information about the total number of admissions within a year and the total number of incidents of aggressive behaviour could be obtained. Possibly crucial ward characteristics, such as staff attitudes towards the use of coercion and excess of bed occupancy in wards, were not assessed. While Virtanen *et al.* [31] found an association between overcrowding and assaults of patients towards staff, Husum *et al.* [9] found no substantial association between staff attitudes towards the use of coercion and the use of coercion itself. In our study, a substantial proportion of variation between wards remained unexplained by the included variables. The complexity of clinical situations could not be recognised. Due to this shortcoming, further analyses should take into account not only structural characteristics of wards, but should also capture features of the situation imminent to a coercive measure.

CONCLUSIONS

The results of this study show that aggressive behaviour before admission and involuntary commitment are meaningful risk factors for the use of coercive measures. Reducing coercive measures may be more successful with early identification of aggressive behaviour and with efforts to lower the threshold of admission.

To identify patients at risk, it is most important to intensively monitor patients with aggressive behaviour prior to admission and with a greater severity of psychopathological symptoms. Further efforts should be undertaken to reduce the threshold for psychiatric inpatient treatment and to increase the proportion of voluntarily admitted patients.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

EF: Statistical analyses, discussion

TS: Introduction, discussion

FE: Data acquisition, discussion

CU: Discussion

JB: Introduction, discussion

All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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