Analysing length of stay disparities in inpatient forensic psychiatric care: a cross-sectional study in Czechia

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Abstract

Background   Length of stay (LoS) is a critical parameter of inpatient forensic treatment functioning. Inpatient forensic LoS in Czechia varies across hospitals with the number of patients per 100,000 inhabitants and the treatment duration. We aimed to analyse these inter-hospital differences and provide relevant sociodemographic and treatment-related data.

Methods   We collected descriptive parameters from 841 forensic inpatients from 13 hospitals in Czechia, with follow-up data collection after 6 months ($N = 800$). Data from eight hospitals with > 50 patients ($N = 765$) were entered into linear regression analyses with subsequent resampling to identify differences in LoS associated with index offence, diagnosis, and treatment type, thereby highlighting interhospital variations.

Results   The cohort comprised predominantly males (mean age, 41.84 years; standard deviation [SD] 3.63) with extended mental health histories; the mean main diagnosis length was 13.2 years (SD 12.18). Most inmates committed violent offences, with psychotic, substance use, or paraphilic disorders predominating. Family contact remained common despite the patients' poor socioeconomic status. The mean LoS was 1,327.58 (SD 1642.41) days. We observed significant differences in LoS among patients from the same diagnostic group. Within the whole system, patients with substance abuse disorders, psychotic disorders, and intellectual disabilities stayed for 760, 1490, and 2441 days, respectively. Violent index offences increased LoS in most hospitals, as did sexual offences, but "other" minor criminal offences (non-violent, non-sexual) were associated with increased LoS only in some hospitals. Sex offender treatment significantly affected LoS in some hospitals, while enrolment into substance use programmes shortened it.

Conclusions   Our study revealed significant inter-hospital variations in LoS associated with index offences, diagnoses, or treatment programs, which could be related to previously unrecognised institutional factors. Regular evaluation of treatment outcomes and implementation of standardised guidelines across the entire system is necessary to balance these differences. The insights provided into inpatient treatment in Czechia can be used to guide policy and practice improvements, enhancing the quality of forensic psychiatric care and ensuring the rights and well-being

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of the patients. The study addressed the knowledge gap existing in the available literature regarding previously unrecognised factors influencing the LoS at the system "mezzo" level.

Keywords Inpatient forensic treatment, Forensic psychiatric care, Czechia, Mental disorder, Forensic length of stay, Forensic psychiatry, Linear regression analysis, Hospital effect, Multicentre study, Representative sample

Background

Forensic psychiatry is an essential interface between mental health care and the criminal justice system, addressing the treatment of mental disorders and the management of offending behaviours [1–4]. Approaches to treating mentally ill offenders vary considerably across Europe, shaped by each country's healthcare system, legal framework, and service organisation [1, 4–6]. Although some countries rely on specialised forensic hospitals, others integrate forensic patients into general psychiatric or prison settings [7, 8]. Similarly, organisational structures differ considerably: Italy favours smaller regional units, whereas Germany, Slovakia, and Czechia combine centralised forensic hospitals with local psychiatric services [5, 9, 10]. Notably, despite a general reduction in psychiatric bed numbers across high-income European countries, forensic bed capacity has increased over recent decades [11, 12].

Within this diverse context, length of stay (LoS)—the duration of inpatient forensic treatment—emerges as a particularly meaningful measure. LoS encapsulates critical aspects of forensic care at the systemic (macro) level, reflecting not only changes in patients' legal status and restrictions on personal freedom but also the effectiveness of therapeutic interventions and availability of follow-up services. LoS could thus be perceived as a critical indicator of whole forensic care system functionality. A forensic organisation that minimises LoS is preferred in situations where presented risks are securable by community services [13]. Unsurprisingly, given the different legal systems and distinct healthcare systems across Europe [1, 8, 14], the LoS in forensic psychiatric care varies dramatically. Moreover, countries such as Belgium and the Netherlands report an average LoS of 9 – 10 years, whereas Italy and Poland observe significantly shorter durations of 2 – 3 years [5, 15, 16]. Patient numbers also vary because LoS parameters are linked to the number of hospitalised individuals at any given time. For instance, the inpatient forensic population in Czechia (with an LoS of approximately 3.6 years) or Croatia would at least double if it had an LoS similar to that of the Netherlands or Scotland with an LoS of 8 or 10 years [5].

On an individual patient level, several studies aimed to identify factors affecting LoS and contributing significantly to prolonged forensic stays [2, 16–20]. Some key factors include the severity of the index offence, history of psychiatric treatment prior to forensic treatment, cognitive deficits, illness severity, diagnoses of schizophrenia or psychotic disorders, and histories of violence or substance misuse [2, 18, 21–23]. However, the results of studies exploring the association of LoS with various predictors are not always consistent for a number of reasons, including the variability in the definition of LoS and statistical approaches [24]. This recent structured review identified a moderate level of evidence for a positive association between LoS and index offence, including severe crimes such as homicide or attempted homicide and criminal legal status with restrictions, only for schizophrenia-spectrum disorders, whereas Global Assessment of Functioning (GAF) was negatively correlated with LoS [24]. Surprisingly, none of the sociodemographic variables, such as age, sex, ethnicity, employment, age at first conviction, or family status, were found to be associated with LoS with a sufficient and reliable level of evidence. Moreover, other characteristics such as institutional behaviour (e.g. violence to self or others while institutionalised), use of seclusion, previous hospitalisations, or Historical Clinical Risk Management-20 (HCR-20) clinical score showed no significant correlation with LoS. Conversely, treatment-related variables including higher HCR-20 clinical score or security needs and severe disruptions of the treatment regime (such as absconding), have been shown to significantly impact LoS [17, 25].

Forensic treatment is inherently coercive, raising ethical concerns owing to its significant restriction of patients' autonomy during extended care periods [26]. As a form of criminal sanction in many systems, it necessitates equal and fair service delivery within a single justice system. Benchmarking service delivery across facilities within national or regional systems is undoubtedly a complex issue, which may explain the limited research on system inequalities or specific regional or facility characteristics related to LoS. One of the only two studies on the "mezzo" systemic level compared LoS across seven regions in the United Kingdom that provide medium-secure forensic psychiatric services [27]. The study found significant regional variations in the average LoS and important differences between regional services in mean bed numbers on an annual basis, per million population, and yearly admission rates, reflecting different service delivery methods [27]. The other study examined how institutional differences between forensic psychiatric units influence the patients' LoS, analysing data from 594 patients with schizophrenia-spectrum disorders across six German forensic hospitals [28]. Analysis employing a linear regression model built upon state government

forensic documentation system explained 49% of the total variance in LoS, with hospital differences accounting for 41%. Among patient characteristics, only age at admission, education level, and offence severity were significant predictors of LoS.

Owing to relatively limited evidence, how the above-mentioned "patient" variables interact with hospital-specific factors, such as inter-facility service delivery differences, regional service arrangements, or application of legal and sub-legal regulations remains unclear. Additionally, how these factors commonly contribute to or are reflected in the "macro" whole-state LoS level is also poorly understood. Identification of regional differences is crucial for the development of service infrastructure, staffing policies, therapeutic programme development, and follow-up services development that can underpin regionally extended LoS. In the study by Coid et al., regions with more resources and lower demand were able to provide a broader range of service styles [27]. Other external factors are also likely to contribute to rising admissions and LoS, such as mental health and criminal legislation, inadequate and under-resourced general mental health services, lack of social and community support, court diversion schemes, aggression risk-averse clinicians, and expanding admission criteria [29].

In Czechia, forensic treatment orders are governed by specific criminal law provisions. These require that the offender had diminished or absent criminal responsibility at the time of the crime, with a direct link between their mental disorder symptoms and their cognitive or behavioural control assessed by an expert witness [30]. The Czech Criminal Code emphasises a principle of minimal restriction whereby inpatient forensic treatment is only mandated when the offender committed the crime while influenced by a mental disorder, their presence in society at large "poses a danger", and the presented risks are not manageable by a community or outpatient services. Courts consider several factors when deciding between inpatient or community treatment, namely expert recommendations, offender characteristics, the severity of the index offense, and other relevant circumstances. Importantly, these evaluations are conducted on an individual basis through clinical expert examinations; Czech courts do not employ or require a standardised risk assessment. Instead, they rely solely on individualised clinical assessments to inform their decisions in forensic treatment cases. The decision to order institutional treatment is in the hands of the court based on a proposal from a court-appointed expert, but there is no minimum severity of the index offense required for this order. However, a certain level of severity of the index offense is required for the imposition of high-security detention, which is part of the prison system [30]. No acceptable regional differences exist in legal or sub-legal regulation of forensic treatment across Czechia or within the medico-legal processes or procedures [31]. Treatment could be ordered as either inpatient or outpatient (within the community); its length is not limited by law, but there is mandated court re-examination of the inpatient treatment within the 24-month interval. Discharge from institutional treatment is a three-stage process. First, the team providing direct care submits a proposal to the hospital board. After approval, the proposal is sent to the court, which may, but is not required to, engage an independent expert to assess whether the conditions for discharge into the community are met [31, 32].

Inpatient forensic services are provided in 14 general psychiatric hospitals with defined catchment areas either in separate wards (e.g. sex offender treatment programme) or in programmes encompassing the general and forensic population (e.g. women with ordered forensic treatment). Besides the healthcare system, the prison system also has a limited number (up to 200) of forensic placements, and 90 additional posts exist in a highly secure service that is also part of the prison system [30]. By the end of 2020, the healthcare system in Czechia reported a total of 839 forensic inpatients, with the number of patients per 100,000 residents fluctuating considerably in different catchment areas; the average duration of treatment ranged from several months to 6 years between hospitals [33]. Previous findings from one hospital identified several patient-related variables associated with longer LoS, including committing multiple violent crimes, non-compliance with the ward or therapeutic regimes, limited insight into mental health, and high scores on Health of the Nation Outcome Scales (HoNOS)-secure scores [34]. Another Czech study demonstrated that higher scores on assessment tools, such as the HoNOS-secure and HCR-20 Version 3 (HCR–20:V3) clinical subscales, were associated with a decreased likelihood of discharge. Conversely, diagnoses of substance use disorders were linked to increased discharge odds, while diagnoses of intellectual disabilities were associated with a reduced likelihood of discharge; index offence type or severity had no influence upon discharge decisions [31]. In Czechia, a unique aspect of the forensic system exists, consisting in that courts traditionally mandate forensic treatment in the form of psychiatric care, paraphilia protective treatment program (PPTP), or substance use treatment, sometimes combining these modalities despite the fact that there is no legal anchor for this division. The court judgment thus outlines the framework of the prescribed treatment programme, the completion of which is determined as part of the legal order [30]. The PPTP is offered at six wards across designated hospitals, with a total capacity of 140 beds. Data from Bohnice Hospital indicate that patients undergoing

this type of treatment have an average LoS of 656 days [35].

Methods

Aim

We aimed to analyse the inpatient forensic treatment system in Czechia to identify differences in service delivery between hospitals using LoS as a dependent variable in a nationally representative sample. For comparison, we chose parameters with the strongest evidence of influencing LoS, such as diagnosis and index offense type. Additionally, we decided to use our system-specific parameter, ordered treatment type, as an indicator of the interventions provided within a given treatment programme. We also aimed to describe the sociodemographic and treatment-related parameters of the inpatient forensic population in Czechia.

Data collection process

This study was conducted as a part of the Czech Ministry of Health's "Deinstitutionalisation project," which included a comprehensive "CENZUS" survey of all national psychiatric facilities providing inpatient forensic care with the overall aim of improving the inpatient forensic treatment system. By July 1, 2021, all forensic patients currently hospitalised in all 13 hospitals managed by the Ministry of Health providing inpatient treatment were invited to participate, and only 36 declined to participate. This initial data collection involved 841 patients enrolled from all 13 hospitals. The second data collection on the same patient group was conducted 6 months later; in cases when, within this 6-month interval, the treatment was terminated, the patient was released to the community treatment or transferred to a high-security facility or prison, the collection was conducted before this move or before the patient transfer. Data obtained by this second data collection included 800 patients (see Additional file 1). Owing to financial limitations and limited data collection possibilities, only two data collections could be undertaken. In addition to the data presented here, instruments were administered to evaluate shifts in values between measurements [31], justifying this method of the cross-sectional study design with who times of data collection.

To be able to process data on sufficiently large samples from individual hospitals statistically, we decided to exclude hospitals with < 50 patients from further processing. Excluding these facilities and after data clearance resulted in a final study sample of 765 patients from eight hospitals. With this final sample, our study population can be considered representative of the overall forensic inpatient population in Czechia.

Data were obtained from multiple sources, including electronic hospital records, legal judgments, patient health notes, and direct input from patients and care staff. To ensure accuracy and consistency, staff members responsible for data collection, including psychologists, social workers, and nurses from participating hospitals, received training in data collection and reporting procedures.

Data analysis

Linear regression analyses of the data were performed using R version 4.0.5 (R Project for Statistical Computing, Vienna, Austria). To ensure the robustness of the test, the coefficients were bootstrapped 5,000 times for 95% confidence intervals based on 5,000 samples [36]. Our choice to use multiple linear regression instead of mixed models was guided by considerations of clarity and interpretability. Linear regression provides a balance between simplicity and explanatory capability, producing clear coefficients that transparently illustrate systemic differences. This transparency allows stakeholders to more easily understand the relationships between variables without introducing complexity. Moreover, this method aligns with the principle of parsimony, offering robust findings while reducing the risk of overfitting. Consequently, our approach supports the generalizability of the results.

Results

The mean treatment length was 1,327.58 (standard deviation [SD] 1642.41) days, and the median LoS was 769 days. The mean sample age was 41.84 (SD 13.63) years, with a median of 40 years. The mean main diagnosis length was 13.20 (SD 12.18) years. Further sample characteristics are shown in Table 1. Treatment is ordered for most patients with a violent index offence, and most patients are deemed to have completely or substantially diminished criminal liability for those offences. Most patients did not have stable relationships and had limited housing possibilities. Nearly one-third of them had limited legal capacity; 45% were diagnosed with psychotic disorders, while 18% were diagnosed with substance use disorders or paraphilias. Correspondingly, the most frequently prescribed medications were antipsychotics and antiandrogens. 52% of the sample was placed in an environment corresponding to a medium-security level.

Figure 1 shows the number of patients per hospital and the number of patients per 100,000 residents in a catchment area. We performed an initial linear regression analysis to determine whether there were significant differences in LoS among hospitals. Although the Dobrany Hospital showed a significantly longer LoS than the Bohnice Hospital (B = 454.50; $p < 0.05$; [− 10.05, 866.30]), the 95% bootstrapped confidence interval included zero, suggesting a possible spurious outcome (Additional file 2). The LoS remained the same across hospitals solely based

Table 1 Sociodemographic description and treatment-related variables of the forensic patients hospitalised in eight hospitals in Czechia (*N* = 786)

	n	**%**
Sex		
Males	705	90
Females	79	10
Unknown	2	0
Index Offence[1]		
Arson	11	1
Murder/attempted murder	80	10
Other violent crime	166	21
Sexual violence against adults	70	9
Sexual violence or other acts against children	87	11
Disorderly conduct	221	28
Criminal activity related to addictive substances	27	3
Minor offences	148	17
Unknown	76	8
Index Offence Category[1]		
Violent crime	246	29
Sex offence	157	20
General criminality	398	45
Unknown	4	0,5
Forensic treatment type [1]		
Psychiatric treatment	527	52
Sex offender treatment	165	13
Substance use treatment (or "combination" treatment)	94	10
Criminal liability		
Completely diminished	319	41
Substantially diminished	318	41
Not substantially diminished	61	8
Preserved	84	11
Unknown	4	0,5
Marital status		
Married/within relationship	38	5
No stable relationship	722	92
Unknown	26	3
Education		
No education	67	9
Elementary school (6 – 15 years) (9 years)	344	44
Vocational school (15 – 18 years) (2-3 years)	269	34
Upper secondary education (15 – 19 years) (4 years)	80	10
Higher education (19 +) (3 – 8 years)	25	3
Unknown	1	0.1
Employment history		
No stable employment before forensic treatment	272	35
Primary employment (≥ 20 hours/week	53	7
Own-account worker	17	2
Temporary employment	29	4
Disability pension	367	47
Retirement pension	37	5
Unknown	11	1
Probation or mediation supervision sentence		
Yes	67	9
No	718	91
Housing (entry to forensic treatment)		

Table 1 (continued)

	n	%
Social housing	21	3
Own housing/living with relatives	424	54
Temporary housing	149	19
Homeless	194	25
Housing (on second data collection)		
Social housing	158	20
Own housing/living with relatives	338	43
Temporary housing	66	8
Homeless	202	26
Unknown	22	03
What preceded forensic treatment		
Prison	215	27
Secure detention (high-security facility)	16	2
Psychiatric hospitalisation in non-forensic bed	89	11
Community forensic treatment	132	17
Home	309	39
Other	25	3
Medication[1]		
No medication prescribed	47	6
Antipsychotics/combination of antipsychotics	502	64
Clozapine prescription	74	9
Antidepressants	32	4
Mood stabilisers	17	2
Antiandrogens	142	18
Restriction of Legal Capacity		
Yes	279	35
No	468	60
Being (re)evaluated	37	5
Unknown	2	0.3
Pathway expected at second data collection		
Exitus	5	0.6
A sentence of imprisonment or detention is expected or in progress	15	2
Transfer to another medical facility is expected	17	2
The prolongation of the inpatient treatment is anticipated	347	44
Proposal for Security Detention transfer (or in consideration)	15	2
Proposal for community transfer (or in consideration)	24	3
Treatment termination proposal	342	44
Unknown	21	3
Diagnoses due ICD-10[1]		
Physiological Disorders (F0*)	36	5
Disorders due to Substance use (F1*)	139	18
Psychotic disorders (F2*)	357	45
Mood/Affective Disorders (F3*)	5	0,6
Stress-related Disorders (F4*)	2	0,3
Behavioral Syndromes (F5*)	2	0,3
Personality Disorders (F6*)	39	5
Paraphilia Disorders (F65*)	142	18
Intellect Disorders (F7*)	57	7
Developmental Disorders (F8*)	2	0,3
Behavioural and emotional disorders in childhood (F9*)	0	0
Unknown	5	0,6
Ward Security Level		
Medium Security	409	52

Table 1 (continued)

	n	%
Low Security	356	45
Unknown	21	3
Abscorsion (last 6 months)		
No	715	91
Yes	36	5
Unknown	21	3
Social Network, n-treatment regular contact with		
Family	494	63
Friends/acquaintances	57	7
Spouse/partner	44	6
No contact	176	22
Use of Restrictive Means (last 6 months)		
No	734	93
Yes	23	3
Yes, repeatedly	8	1
Unknown	21	3
Substance Use (last 6 months)		
No	669	85
Yes, once	43	5
Yes, repeatedly	53	7
Unknown	21	03

Frequencies (%) of values on entry/exiting. Data from two participants were lost regarding sex. [1]In Czechia, forensic treatment is traditionally ordered as "psychiatric", "sex-offender", or "substance use". [2]For index offence categories, see Additional file 3
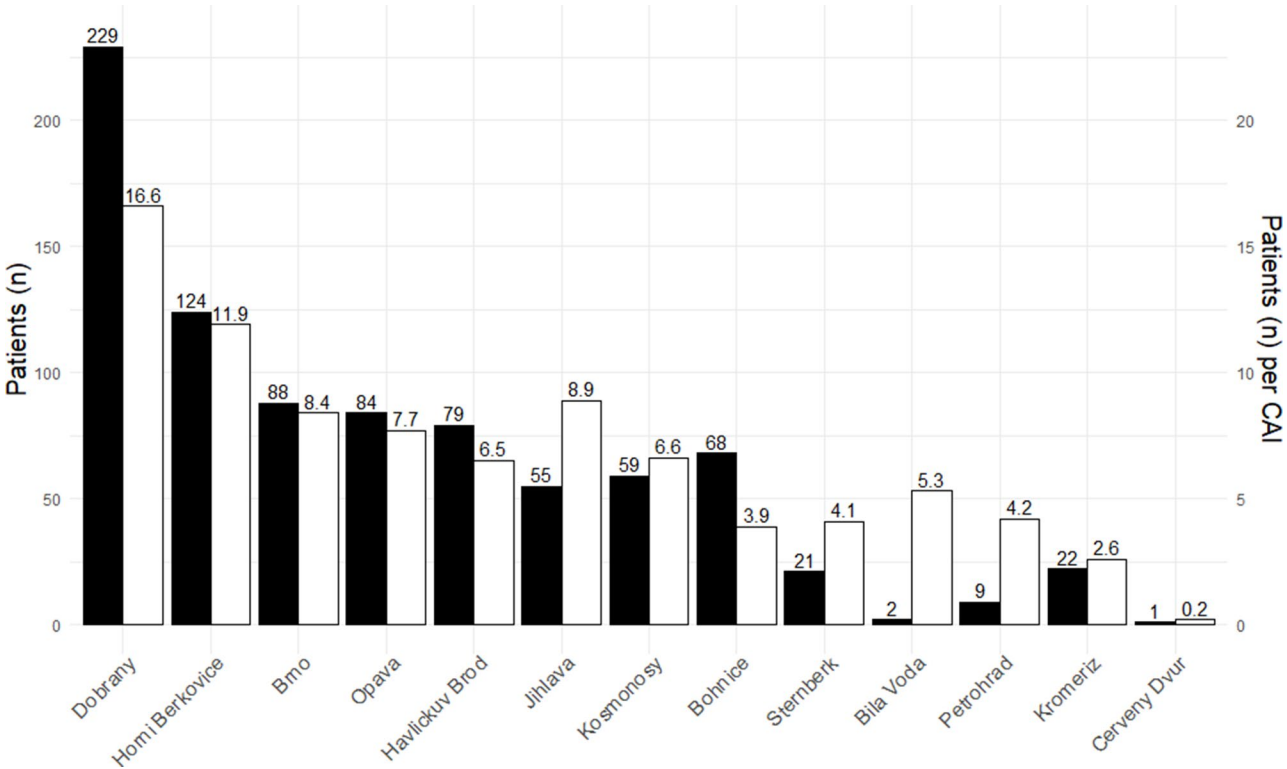

Fig. 1 Number of patients per hospital and number of patients per 100,000 residents in a catchment area, all forensic hospitals in Czechia (*N* = 841). CAI, catchment area inhabitants

Table 2 Association between diagnoses and length of stay within the inpatient forensic treatment in czechia, all hospitals with 50 or more patients (*n* = 765)

	Estimate, (95% CI)
Estimate, (95% CI) F20-F29 Schizophrenia, schizotypal and delusional disorders	**1,490.00***** (1,313.00, 1,684.00)
F00-F09 Organic, including symptomatic mental disorders	**-224.00** (-553.80, 100.40)
F10-F19 Mental and behavioural disorders due to psychoactive substance use	**-726.30***** (-964.60, -499.00)
F30-F39 Mood [affective] disorders	152.80 (-1,142.00, 2,818.00)
F40-F49 Neurotic, stress-related and somatoform disorders	-1,147.00 (-1,409.00, -891.90)
F50-F59 Behavioural syndromes associated with physiological disturbances and physical factors	-1,035.00 (-1,379.00, -701.90)
F60-F69 Disorders of adult personality and behaviour	**-368.10*** (-627.20, -122.70)
F70-F79 Intellectual disability	**951.00***** (210.90, 1,817.00)
F80-F89 Disorders of psychological development	-371.40 (-582.20, -176.20)
Observations	765
R^2	0.06
Adjusted R^2	0.02
Residual Std. Error	1,597.00 (df = 756)
F Statistic	6.51*** (df = 8; 756)

Note: Bold values have bootstrapped 95% CIs without 0 *p*<0.05; *p*<0.01; *p*<0.001

Diagnoses were coded according to the International Classification of Diseases (ICD-10); length of stay is expressed in days. CI, confidence interval

Table 3 Association of the main diagnostic groups with length of stay in eight forensic hospitals in Czechia (*n* = 765)

Estimate, (95% CI)				
Hospital	Constant (other diagnoses)	F60-F69 Disorders of adult personality and behaviour	F10-F19 Mental and behavioural disorders due to psychoactive substance use	F20-F29 Schizophrenia, schizotypal and delusional disorders
Constant (Bohnice)	1,012.00 (353.00, 2,259.00)	671.90 (-805.50, 1,810.00)	-710.20 (-2,043.00, 0.50)	97.19 (-1,289.00,1,077.00)
Brno	-154.70 (-1,549.00, 713.60)	-68.12 (-1,439.00, 679.40)	-267.60 (-1,685.00, 923.50)	918.80 (-712.60, 2,261.00)
Dobrany	1,475.00* (-16.83, 2,707.00)	391.20 (-987.90, 1,315.00)	-130.20 (-1,481.00, 621.20)	719.10 (-645.80, 1,530.00)
Havlickuv Brod	668.30 (-1,031.00, 2,616.00)	-406.70 (-1,700.00, 287.40)	-81.67 (-1,556.00, 1,250.00)	564.10 (-843.40, 1,472.00)
Horni Berkovice	1,610.00 (-351.50, 3,882.00)	452.40 (-1,020.00, 1,469.00)	-336.10 (-1,668.00, 372.90)	697.60 (-687.50, 1,652.00)
Jihlava	11.60 (-1,498.00, 1,378.00)	-569.30 (-1,862.00, 118.70)	-415.90 (-1,736.00, 404.20)	1,517.00 (-320.90, 3,377.00)
Kosmonosy	45.60 (-1,304.00, 926.50)	-168.60 (-1,516.00, 604.70)	349.40 (-1,233.00, 1,764.00)	-77.18 (-1,434.00, 712.40)
Opava	228.90 (-1,162.00, 1,255.00)	**1,584.00** (351.70, 2,243.00)	**-772.00** (-2,064.00, -109.50)	-169.60 (-1,476.00, 550.00)
Observations	765			
R^2	0.12			
Adjusted R^2	0.09			
Residual Std. Error	1,571.00 (df = 733)			
F Statistic	3.29*** (df = 31; 733)			

Note: bold values have bootstrapped 95% CIs without 0 *p*<0.05; *p*<0.01; *p*<0.001

Diagnoses were coded according to the International Classification of Diseases (ICD-10); length of stay is expressed in days. "Other diagnoses" comprise all ICD-10 F diagnoses F00-F99 except F10-F19, F20-F29, and F60-F69 diagnoses. CI, confidence interval

on location; therefore, subsequent analyses focused on different patient-related variables. Bohnice Hospital was selected as the reference point in all sequential models based on previous studies on patient variables affecting LoS [34, 37, 38].

In the subsequent data analysis, we primarily examined whether diagnoses affected LoS across all grouped hospitals. The resulting model demonstrated a good fit to the data (F (8; 756) = 6.51; *p* < 0.001) and revealed significant differences in LoS (Table 2). Specifically, patients diagnosed with substance use disorders, stress-related disorders, personality disorders, and adolescent-onset behavioural or emotional disorders had shorter stays than those diagnosed with psychotic disorders. However, patients diagnosed with intellectual disabilities (B = 951.00; *p* < 0.001; [210.90, 1817.00]) were the only group that stayed in the facility significantly longer than those with psychotic disorders. We subsequently categorised the patients into four groups to assess the impact of the diagnosis on LoS within individual hospitals (Table 3). Regression analysis revealed relatively small differences in LoS between groups, except for patients with other diagnoses in the Dobrany Hospital (B = 1475.00; *p* < 0.05; [-16.83, 2707.00]). Despite the non-significant p-values,

the 95% bootstrapped confidence intervals suggested that patients diagnosed with substance use disorder had shorter stays (B = − 772.00; $p = 0.37$; [− 2064.00, − 109.50]), while patients diagnosed with personality disorder stayed longer (B = 1584.00; $p = 0.36$; [351.70, 2243.00]) in the Opava Hospital than those with other diagnoses in the Bohnice Hospital. For diagnoses distribution in individual hospitals, see Additional file 3.

Furthermore, we examined the impact of index offence on the length of treatment within the enrolled hospital samples. Regression analysis revealed that the index offence type significantly affects LoS in different hospitals (Table 4). Patients who committed "other offences" (nonviolent, non-sexual) stayed the longest in the Dobrany (B = 841.60; $p < 0.01$; [523.10, 1155.00]) and Horni Berkovice (B = 808.60; $p < 0.05$; [296.70, 1393.00]) Hospitals. Patients who committed sexual offences stayed the longest in the Dobrany Hospital (B = 1407.00; $p < 0.001$; [666.50, 2226.00]) and stayed longer in the Bohnice, Brno, and Horni Berkovice Hospitals than patients who committed "other offences" and were admitted to the Bohnice Hospital. Patients who committed violent offences had significantly longer stays in Bohnice (B = 2068.00; $p < 0.001$; [856.90, 3476.00]), Jihlava (B = 1653.00; $p < 0.001$; [244.80, 3391.00]), Dobrany (B = 1523.00.00; $p < 0.001$; [915.40, 2301.00]), Brno (B = 1,064.00; $p < 0.01$; [394.40, 1,892.00]), and Horni Berkovice Brno (B = 1,004.00; $p < 0.01$; [464.90, 1,627.00]) hospitals, compared to those who committed "other offences" and were admitted to Bohnice Hospital. For index offence grouping, see Additional file 4.

Finally, in the Czech system, the court usually mandates treatment based on the offence committed (psychiatric, sex offense-PPTP, or substance abuse); therefore, we analysed the differences in the effects of these categories on LoS. Whole-system evaluation with all hospitals grouped revealed that patients undergoing substance abuse treatments (B = − 696.60; $p < 0.01$; [− 956.40, − 401.10]) stayed for shorter periods than those undergoing psychiatric treatments (B = 1434.00; $p < 0.01$; [1289.00, 1588.00]) (Additional file 5). When analysing the effect of treatment type on LoS within individual hospitals, significant differences were observed in the provision of treatment for sex offenders and individuals with substance use disorders (Table 5). The provision of PPTP in the Dobrany Hospital lasted longer (B = 786.90; $p < 0.01$; [-77.28, 1691.00]), whereas in the Havlickuv Brod Hospital it was significantly shorter (B = -557.70; $p < 0.01$; [-1114.00, -83.57]), compared to the psychiatric treatment in the Bohnice Hospital. The substance use treatment in the Kosmonosy, Havlíčkův Brod, Jihlava, Opava, and Horní Berkovice Hospitals was significantly shorter compared to the psychiatric treatment in the Bohnice Hospital (B = -1170.00; $p < 0.001$; [726.50, 1703.00]).

Discussion

This study examined LoS disparities in inpatient forensic psychiatric care across Czechia, highlighting significant inter-hospital variations influenced by diagnosis, index offense type, and treatment programs; the study was not designed to evaluate the effectiveness of the provided care in hospitals enrolled in the comparison. Instead, we aimed to highlight the inconsistency in the execution of these measures, as it is a type of criminal sanction, and emphasise that the comparability of its implementation or exertion across different facilities should be ensured. We observed that the LoS of diagnostic groups significantly varied across placements in different hospitals; patients with psychotic disorders tend to stay longer in treatment than those with substance use disorders.

Table 4 Association of index offences with length of stay in eight forensic hospitals in Czechia ($n = 761$)

Estimate, (95% CI)			
Hospital General criminality		Sexual Offences	Violent offences
Constant (Bohnice)	557.60* (388.90, 803.80)	514.80 (101.30, 974.00)	2,068.00*** (856.90, 3,476.00)
Brno	587.60 (-38.44, 1,419.00)	326.60 (37.95, 575.40)	1,064.00* (394.40, 1,892.00)
Dobrany	841.60** (523.10, 1,155.00)	1,407.00*** (666.50, 2,226.00)	1,523.00*** (915.40, 2,301.00)
Havlickuv Brod	704.20 (274.20, 1,158.00)	53.52 (-230.00, 292.90)	970.80* (338.50, 1,736.00)
Horni Berkovice	808.60* (296.70, 1,393.00)	815.50 (371.30, 1,266.00)	1,004.00** (464.90, 1,627.00)
Jihlava	405.60 (-0.85, 874.30)	1,608.00 (-301.20,4,712.00)	1,653.00*** (244.80, 3,391.00)
Kosmonosy	260.90 (-87.81, 634.90)	370.90 (19.19, 751.30)	665.50 (174.90, 1,199.00)
Opava	267.40 (-33.04, 545.90)	203.90 (-520.50, 904.10)	347.30 (-4.46, 744.10)
Observations	761		
R²	0.08		
Adjusted R²	0.05		
Residual Std. Error	1,604.00 (df = 737)		
F Statistic	2.73*** (df = 23; 737)		

Note: bold values have bootstrapped 95% CIs without 0 *p<0.05; **p<0.01; ***p<0.001

Length of stay is expressed in days; please see the index offence grouping in Additional file 3. CI, confidence interval

Table 5 Effect of forensic treatment type on length of stay between eight forensic hospitals in Czechia (*n* = 765)

Hospital	Psychiatric treatment	Substance use treatment	Sex-offender treatment
Estimate, (95% CI)			
Bohnice (constant)	1,170.00*** (726.50, 1,703.00)	301.20 (-1,316.00, 3,795.00)	-44.16 (-705.50, 601.60)
Brno	190.30 (-498.10, 861.80)	513.50 (-970.90, 2,980.00)	-323.10 (-875.90, 150.20)
Dobrany	506.40 (-98.09, 1,029.00)	-336.50 (-934.10, 230.60)	**786.90*** (-77.28, 1,691.00)
Havlickuv Brod	416.30 (-258.90, 1,068.00)	**-873.00** (-1,422.00, -416.80)	**-557.70** (-1,114.00, -83.57)
Horni Berkovice	367.20 (-286.90, 974.70)	**-578.20** (-1,127.00, -115.00)	811.70 (-168.40, 2,032.00)
Jihlava	656.10 (-355.60, 1,844.00)	**-731.20** (-1,386.00, -46.08)	996.20 (-1,066.00, 4,205.00)
Kosmonosy	-86.87 (-715.70, 467.60)	**-825.20** (-1,358.00, -380.50)	-255.40 (-837.50, 274.20)
Opava	-299.90 (-862.80, 185.50)	**-732.40** (-1,301.00, -247.80)	795.70 (-194.80, 1,739.00)
R2	0.07		
Adjusted R2	0.04		
Residual Std. Error	1,606.00 (df = 741)		
Statistic	2.54*** (df = 23; 741)		

Note: Bold values have bootstrapped 95% CIs without 0 *p*<0.05; *p*<0.01; *p*<0.001

Length of stay in days. In Czechia, courts order forensic treatment to be carried out in one of three programs: (1) Psychiatric treatment, (2) Sex-offender treatment (paraphilia protective treatment program - PPTP), (3) Substance use treatment. CI, confidence interval

Violent and sexual index offenses were associated with prolonged LoS in most hospitals. In some facilities, individuals committing minor offences also experienced significantly extended stays. Although patient-related factors undoubtedly play a significant role, the influence of the facilities themselves and their impact on LoS cannot be overlooked.

The forensic treatment system LoS in Czechia is approximately 3.6 years, similar to systems in Croatia and Italy [39]. In contrast, countries like Great Britain and Germany have an average LoS approximately twice as long [5]. The majority of the present study population was male, with an average age of 42 years, which is consistent with the Polish sample [20] and younger than the long-stay patients in England and the Netherlands [40]. Compared to Weber et al.'s report on a Swiss sample, the patients were older, and treatment was less frequently mandated for violent and sexual offences [41]. Our study sample population is characterised by relatively poor psychosocial adaptation, low educational levels, and fewer relationships compared to the general population, consistent with previous findings [18, 19]. The average duration of mental health problems was 13.2 years, highlighting the long-term nature of these challenges and their association with subsequent socioeconomic difficulties. The majority of the study population comprised patients with psychotic disorders, addictions, personality disorders, paraphilias, organic problems, and intellectual insufficiency. Their diagnostic spectrum did not significantly differ from other European cohorts [19, 20, 23]. A low level of restraint use was recorded during treatment, with only 3% of the inpatient forensic population subjected to any form of restraint within the 6-month study period, which is lower than the rates reported by Lau et al. [42]. We observed widespread use of pharmacotherapy, with only 6% of patients not receiving any medications. The

majority of the cohort were prescribed antipsychotic medications, either as monotherapy or in combination therapy, which may raise specific considerations, as outlined by Farrell and Brink [43].

A significant variation in patient numbers between hospitals was evident, ranging from 16 to approximately three hospitalised patients per 100 inhabitants in the respective catchment areas. This disparity obviously reflects the complex interplay of factors influencing forensic psychiatric admissions. One key factor is the higher prevalence of severe mental illness in urban areas compared to rural ones, which provides a basis for elevated forensic inpatient rates in more urbanised settings [44, 45]. However, contrasting evidence from rural Germany indicates that admission rates for patients with schizophrenia and affective disorders tend to decrease as population density increases [46]. Another critical factor shaping forensic admissions is socioeconomic deprivation, which has been shown to have a stronger association with forensic hospitalization rates in urban areas than in rural ones [44]. Interestingly, our observations reveal that hospitals with the highest numbers of hospitalised patients per 100 inhabitants are situated in rural settings. Conversely, facilities in urbanised areas, such as Bohnice and Brno, report relatively lower or "average" patient numbers. Although this finding may seem counterintuitive given the urban-rural differences in mental illness prevalence, it highlights the multifaceted nature of forensic psychiatric care. Urban forensic facilities often benefit from greater access to specialised rehabilitative resources and follow-up care compared to their rural counterparts [47], which could influence admission patterns and care pathways. In Czechia, the allocation of patients to psychiatric hospitals for inpatient forensic treatment is determined by court orders, with each hospital being responsible for executing treatment within its

designated catchment area defined in Appendix 8 of the Court Office Rules, which often span multiple administrative regions. For instance, the Psychiatric Hospital in Dobřany serves as a facility for inpatient forensic treatment not only for the Karlovy Vary and Plzeň regions but also for parts of the Central Bohemian and South Bohemian regions. This regional arrangement, rooted in historical developments, does not align with the current county divisions of the Czech Republic. Consequently, cooperation with regional providers of follow-up services within a hospital's catchment area can be challenging, possibly further complicating patients' seamless transition to community forensic psychiatric care or social care facilities.

Patients diagnosed with schizophrenia and related disorders (F20-F29) were used as the reference group when analyzing the relationship between LoS and diagnostic categories, as they represent the most significant proportion of the cohort, which is consistent with previous studies [48, 49]. Patients with substance use disorders (F10-F19) or personality disorders (F60-F69) generally had shorter stays compared to those with psychotic disorders. This supports the growing evidence of the significant impact of psychotic disorders on forensic LoS [17, 21], especially in cases involving persistent symptoms or treatment resistance, evidenced by a clozapine prescription [49]. However, our results contrast with Andreasson's findings [48], which associated substance use disorders with longer LoS. Patients diagnosed with intellectual disabilities (F70-F79) had significantly longer stays than those with psychotic disorders, on average, for 951 days. This is consistent with an observation that a diagnosis of intellectual disability was associated with a lower likelihood of discharge in a study evaluating the effectiveness of cognitive behavioural anger treatment [50]. Our previous finding replicated this finding [31]. In our current observation, we diverge from a Polish study that reported no impact of intellectual disability on LoS [20]. The issue is undoubtedly complex; e.g., Alexander et al. noted that clinical diagnoses or offending behaviour categories are poor predictors of LoS for this diagnostic group [52], and the availability of follow-up services or specialised programs is also at play. Despite the fact that our analysis shows that hospital location and diagnostic group significantly influence LoS, it also highlights considerable variability. The linear regression model explains only a small portion of the variation ($R^2 = 0.12$, adjusted $R^2 = 0.09$), suggesting that many other factors (hospital policies, staff availability, material resources, or patient characteristics) contribute to differences in LoS; the F-statistic of 3.29 ($p < 0.001$) however indicates that the model is statistically significant overall.

Examination of the relationship of the index offence impact on LoS reveals compelling evidence linking the severity of index offences to longer LoS in forensic psychiatric facilities across Czechia, which is consistent with previous findings [17, 20–22, 24]. Violent and sexual offences were associated with prolonged LoS in most facilities. However, we also observed unexpected patterns, such as extended stays for patients who committed non-violent/non-sexual "other offences" in some hospitals; a moderate level of evidence suggests no significant correlation between minor or mixed offenses with LoS [24]. This finding raises questions about the proper application of the risk-need-responsivity principle and suggests that hospital-related factors, rather than patient-related variables, may be influencing LoS in this group. Differences in resources, service styles, hospital location, and treatment delivery between hospitals likely contribute to these variations. For instance, Dobrany Hospital (and also Horní Berkovice Hospital) demonstrated consistently longer LoS regardless of the offense category, indicating a strong hospital-specific effect on treatment duration overall. These facilities also show the highest relative number of patients per 100,000 inhabitants of the catchment area. Notably, although this analysis identifies notable relationships between offense types and LoS, the low R^2 values found in the present study suggest that unmeasured factors play a substantial role in determining LoS. The interplay between these complex underlying factors and hospital effects on LoS warrant further investigation to better understand and address the observed disparities.

In Czechia, forensic treatment is divided into three categories: psychiatric, sex offender (PPTP), and substance use. These categories align with the diagnostic characteristics of the index offense and guide therapeutic approaches. Courts mandate specific treatment programs based on the most significant risk factors identified during the offense. For example, if an expert witness report identifies substance use disorder or intoxication that impaired the individual's ability to control their actions, the court may order addiction treatment. This treatment can be implemented before, during, or after a prison sentence and is typically conducted in specialised departments. Upon completion, the treatment is deemed finished by the facility and the court, leading to discharge or transition to community-based care. Substance use treatment is generally shorter than psychiatric treatment, which addresses a broader range of diagnoses, primarily psychotic disorders. Similarly, treatment for F6 diagnoses (e.g., paraphilia disorders) is shorter than for F2 diagnoses (psychotic disorders). Notably, sex offender treatment is only mandated for individuals diagnosed with paraphilia and not all sexual violence offenders. Our findings revealed that LoS for sex offenders varies significantly between hospitals despite a standardised national program [35, 51]. When "controlling" for treatment type,

our results align with diagnostic characteristics: patients undergoing psychiatric treatment (primarily for psychotic disorders) have longer stays compared to those in substance use programs. Although the F-statistic of 2.54 ($p < 0.001$) suggests that the overall model is statistically significant, the model's low R^2 (0.07) and adjusted R^2 (0.04) values indicate that it explains only a small portion of the variance in LoS and that other factors are involved, similar to models above.

Strengths and limitations

This study offers a broad analysis of forensic psychiatric care across an entire state, shedding light on hospital- related factors that influence LoS. It addresses a notable gap in the literature, particularly in the context of Central and Eastern Europe, where data on forensic care populations and treatment systems remain limited. Certain limitations of our findings should be considered. The multicentre design, while inclusive, may introduce researcher bias owing to differences in qualifications and expertise among data collectors. Additionally, the cross-sectional nature of the study provides only a "snapshot" of ongoing treatments rather than definitive LoS outcomes. Using LoS from completed hospitalizations would provide a more accurate description of the population. Regular or longitudinal data collection would offer a more accurate and detailed understanding of system dynamics over time. The relatively small samples from individual hospitals likely encompass patients with diverse risk profiles, institutional behaviors, levels of inpatient violence, and disease severity. These factors may influence results but are not fully accounted for in our analyses. Furthermore, not using advanced tools such as structured risk assessments or needs mapping may have resulted in key variables contributing to inter-facility differences being overlooked, and deeper insights into the offender population by the use of standardised risk assessment tools such as the HCR-20, STATIC-99, or STABLE-2007 is needed [52–54]. To gain a more comprehensive understanding, adjusting the LoS of the offender population in a given hospital would require considering the more profound description of the hospitalised cohort and assessment of the severity of their risk levels to be able to evaluate program effectiveness in a given facility [55]. This adjustment according to the risks is crucial to program evaluation because the rehabilitation of repeatedly hospitalised offenders or high-risk offenders requires more time. By incorporating these factors, future research could offer a more nuanced analysis of LoS variations and their relationship to offender characteristics, as well as risk profiles. This approach would not only enhance our understanding of factors affecting LoS but also potentially improve the efficacy of rehabilitation programs for e.g. sex offenders [56].

Finally, the regression models used only explain a small portion of the variability in LoS, as reflected by their low R^2 values. This highlights the complexity of factors influencing LoS in forensic settings and suggests that additional variables not explored by our regression models may play a significant role, like patient ethnicity, language skills, institutional behaviour, number and qualification of staff, or availability of specialized therapeutic programs. The wide confidence intervals and low explanatory power of the model underscore the complexity of factors determining LoS, pointing to the need for further research to identify additional factors. Despite these limitations, we hope that our findings provide insights into the functioning of the forensic psychiatric care system in Czechia, which will be beneficial for domestic stakeholders and experts from other countries. Moreover, we highlight areas for improvement in future research as a more comprehensive approach incorporating longitudinal data and additional risk predictive tools could help clarify the factors driving variability in LoS across facilities.

Conclusion

Our findings reveal significant disparities in LoS within Czech forensic psychiatric services, influenced by index offenses, diagnoses, and treatment programs. Larger facilities often report longer treatment durations, which may reflect hospital-related factors such as resource availability and service delivery styles. These disparities highlight systemic challenges in ensuring equitable access to forensic care across regions. The Czech forensic treatment system currently operates under strong legal regulation but lacks systemic oversight. Treatment delivery is governed at the individual patient level, with no structured reporting mechanisms to monitor progress or outcomes across institutions. The reliance on unstructured medical reports possibly contributes to inconsistencies in service delivery and hinders efforts to address disparities in LoS. To address these issues, the standardized use of the Risk-Need-Responsivity model and implementation of the unified evaluation framework is essential. This systematic data collection and structured progress reporting would enable better monitoring of treatment outcomes and facilitate comparisons between institutions, taking in account factors outside their control. This analysis can then serve as a basis for steps towards potential changes in areas of regulation that are not entrusted to the Ministry of Health. Additionally, a better understanding of the needs of a forensic population enables strategic development, which should prioritise infrastructure expansion, workforce planning, and diversified therapeutic program development tailored to specific diagnostic groups. For example, specialised interventions for patients with intellectual disabilities could significantly reduce LoS while improving care quality and patient

outcomes. The currently applied traditional approach of ordering treatment into three distinct types or their combinations also warrants consideration. The forensic population is characterised by needs across multiple domains, and treatment based on an individualised profile of needs, protective factors, and risk factors would better align with contemporary concepts of forensic care. Regional disparities further emphasise the need for targeted resource allocation. Hospitals in underserved areas should receive priority for infrastructure and program development to ensure equitable access to forensic care nationwide. Addressing these gaps would enhance the efficiency of forensic psychiatric services while upholding ethical standards by minimizing restrictions on patient autonomy.

Abbreviations
GAF   Global Assessment of Functioning
LoS   Length of stay
HoNOS   Health of the Nation Outcome Scales
HCR-20:V3 Historical Clinical Risk Management-20 Version 3
PPTP   Paraphilia protective treatment programme

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s13033-025-00675-9.

Supplementary Material 1: Additional file 1. Study plot. Additional file 2. Differences in LoS across all forensic hospitals in Czechia (N=841). Additional file 3. Distribution of diagnoses in individual hospitals in Czechia (N=841). Additional file 4. Index offence grouping. Additional file 5. Effect of forensic treatment type on length of stay in eight forensic hospitals in Czechia with 50 or more forensic placements (n=765). Additional file 6. Study dataset

Author contributions
All authors listed meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors. All authors agree with the manuscript. The author's contributions are as follows: MP contributed to all aspects of the project: design, preparation, data collection, data analysis, and drafting and finalisation of the manuscript, and contributed to ensuring the payment of publication costs. OV contributed to data collection, data analysis, and drafting and finalisation of the manuscript. JZ contributed to the drafting and finalisation of the manuscript. JP contributed to the drafting and finalisation of the manuscript. MZ-K contributed to the study design, drafting, and finalisation of the manuscript. MA contributed to the drafting and finalisation of the manuscript and ensured the payment of publication costs. SP contributed to the study design, data collection, drafting, and finalisation of the manuscript and ensured the payment of publication costs.

Data availability
The dataset(s) supporting this article's conclusions are included as additional files (Additional file 6) within the article.

Declarations

Ethics approval and consent to participate
The study was approved by the Ethics Committee of Bohnice Psychiatric Hospital and conducted in accordance with national legislation and institutional requirements. All participants provided informed consent prior to inclusion in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References
1. Beis P, Graf M, Hachtel H. Impact of Legal Traditions on Forensic Mental Health Treatment Worldwide. Front Psychiatry [Internet]. 2022 Apr 25 [cited 2023 Jul 3];13:876619. Available from: http://www.ncbi.nlm.nih.gov/pubmed/35546946
2. Edworthy R, Vollm B. Long-stay in high and medium secure forensic psychiatric care – Prevalence, patient characteristics and pathways in England. European Psychiatry [Internet]. 2016 [cited 2020 Oct 13];33(S1):S180–S180. Available from: https://www.cambridge.org/core/journals/european-psychiatry/article/longstay-in-high-and-medium-secure-forensic-psychiatric-care-prevalence-patient-characteristics-and-pathways-in-england/451433CF7E56CDEAE6695926A505FF5E
3. Dressing H, Salize HJ. Compulsory admission of mentally ill patients in European Union Member States. Soc Psychiatry Psychiatr Epidemiol [Internet]. 2004 Oct 1 [cited 2023 Jun 30];39(10):797–803. Available from: https://link.springer.com/article/https://doi.org/10.1007/s00127-004-0814-9
4. van Lier E, Tort-Herrando V. Organization and funding of forensic psychiatric facilities across Europe. Forensic psychiatry and psychology in Europe. Cham: Springer International Publishing; 2018. pp. 113–28.
5. Tomlin J, Lega I, Braun P, Kennedy HG, Herrando VT, Barroso R et al. Forensic mental health in Europe: some key figures. Soc Psychiatry Psychiatr Epidemiol [Internet]. 2021 Jan 1 [cited 2022 Jul 25];56(1):109–17. Available from: https://link.springer.com/article/https://doi.org/10.1007/s00127-020-01909-6
6. Salize HJ, Dreßing H. Placement and treatment of mentally ill offenderes- legislation and practice in EU members. Manheim; 2005.
7. Salize HJ, Lepping P, Dressing H. How harmonized are we? Forensic mental health legislation and service provision in the European Union. Crim Behav Ment Health [Internet]. 2005 [cited 2023 Jul 3];15(3):143–7. Available from: https://pubmed.ncbi.nlm.nih.gov/16575818/

8.   Salize HJ, Dressing H, Fangerau H, Gosek P, Heitzman J, Markiewicz I, et al. Highly varying concepts and capacities of forensic mental health services across the European union. Front Public Health. 2023;11:75.

9.   Di Lorito C, Castelletti L, Lega I, Gualco B, Scarpa F, Völlm B. The closing of forensic psychiatric hospitals in Italy: Determinants, current status and future perspectives. A scoping review. Int J Law Psychiatry [Internet]. 2017 Nov 1 [cited 2023 Jul 3];55:54–63. Available from: https://pubmed.ncbi.nlm.nih.gov/29157512/

10. Mundt AP, Frančišković T, Gurovich I, Heinz A, Ignatyev Y, Ismayilov F, et al. Changes in the provision of institutionalized mental health care in post-communist countries. PLoS One [Internet]. 2012 Jun 8 [cited 2021 May 4];7(6). Available from: /pmc/articles/PMC3371010/

11. Chow WS, Priebe S. How has the extent of institutional mental healthcare changed in Western Europe? Analysis of data since 1990 [Internet]. Vol. 6, BMJ Open. BMJ Publishing Group; 2016 [cited 2021 May 4]. p. 10188. Available from: /pmc/articles/PMC4854016/

12. Priebe S, Frottier P, Gaddini A, Kilian R, Lauber C, Martínez-Leal R et al. Mental health care institutions in nine European countries, 2002 to 2006. Psychiatr Serv [Internet]. 2008 [cited 2023 Jul 3];59(5):570–3. Available from: https://pubmed.ncbi.nlm.nih.gov/18451020/

13. Völlm BA, Clarke M, Herrando VT, Seppänen AO, Gosek P, Heitzman J et al. European Psychiatric Association (EPA) guidance on forensic psychiatry: Evidence based assessment and treatment of mentally disordered offenders. Eur Psychiatry [Internet]. 2018 Jun 1 [cited 2023 Jul 7];51:58–73. Available from: https://pubmed.ncbi.nlm.nih.gov/29571072/

14. van der Wolf M, van Marle H. Legal approaches to criminal responsibility of mentally disordered offenders in Europe. Forensic Psychiatry Psychol Europe. 2018;31–44.

15. Edworthy R, Sampson S, Völlm B. Inpatient forensic-psychiatric care: Legal frameworks and service provision in three European countries. Int J Law Psychiatry [Internet]. 2016 Jul [cited 2018 Sep 13];47:18–27. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0160252716300401

16. Sampson S, Edworthy R, Völlm B, Bulten E. Long-Term forensic mental health services: an exploratory comparison of 18 European countries. Int J Forensic Ment Health. 2016;15(4):333–51.

17. Eckert Mareike, Schel SHH, Harry G, Kennedy K, Bulten BH (Erik), editors. Patient characteristics related to length of stay in Dutch forensic psychiatric care. J Forens Psychiatry Psychol. 2017;28(6):863–880.

18. Davoren M, Byrne O, O'Connell P, O'Neill H, O'Reilly K, Kennedy HG. Factors affecting length of stay in forensic hospital setting: Need for therapeutic security and course of admission. BMC Psychiatry [Internet]. 2015 Nov 23 [cited 2020 Oct 12];15(1):1–15. Available from: https://link.springer.com/articles/https://doi.org/10.1186/s12888-015-0686-4

19. Völlm BA, Edworthy R, Huband N, Talbot E, Majid S, Holley J et al. Characteristics and pathways of long-stay patients in high and medium secure settings in England; A secondary publication from a large mixed-methods study. Front Psychiatry [Internet]. 2018 Apr 16 [cited 2020 Jul 9];9(APR):140. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29713294

20. Gosek P, Kotowska J, Rowińska-Garbień E, Bartczak D, Heitzman J. Factors influencing length of stay of forensic patients: impact of clinical and psychosocial variables in medium secure setting. Front Psychiatry [Internet]. 2020 [cited 2020 Oct 8];11:810. Available from: www.frontiersin.org.

21. Huband N, Furtado V, Schel S, Eckert M, Cheung N, Bulten E et al. Characteristics and Needs of Long-Stay Forensic Psychiatric Inpatients: A Rapid Review of the Literature [Internet]. Vol. 17, International Journal of Forensic Mental Health. Routledge; 2018 [cited 2020 Oct 13]. pp. 45–60. Available from: https://www.tandfonline.com/doi/full/https://doi.org/10.1080/14999013.2017.1405124

22. Ross T, Querengässer J, Fontao MI, Hoffmann K. Predicting discharge in forensic psychiatry: the legal and psychosocial factors associated with long and short stays in forensic psychiatric hospitals. Int J Law Psychiatry. 2012;35(3):213–21.

23. Shah A, Waldron G, Boast N, Coid JW, Ullrich S. Factors associated with length of admission at a medium secure forensic psychiatric unit. J Forens Psychiatry Psychol [Internet]. 2011 Aug [cited 2021 Jul 9];22(4):496–512. Available from: https://www.tandfonline.com/doi/abs/https://doi.org/10.1080/14789949.2011.594902

24. Dima A, Wazir A, Clark-Castillo R, Zakopoulos I, Smith S, Gaughran F. Factors influencing the length of stay in forensic psychiatric settings: a systematic review. BMC Health Serv Res [Internet]. 2024 Dec 1 [cited 2024 Oct 8];24(1):1–17. Available from: https://link.springer.com/article/https://doi.org/10.1186/s12913-024-10863-x

25. Olagunju AT, Bouskill SL, Olagunju TO, Prat SS, Mamak M, Chaimowitz GA. Absconsion in forensic psychiatric services: a systematic review of literature. CNS Spectr. 2022;27(1):46–57. https://doi.org/10.1017/S1092852920001881.

26. Hettema P. Ethical Aspects of Long-Stay Forensic Psychiatric Care. Long-Term Forensic Psychiatric Care [Internet]. 2019 [cited 2021 Jul 22];47–62. Available from: https://link.springer.com/chapter/10.1007/978-3-030-12594-3_5

27. Coid J, Kahtan N, Gault S, Cook A, Jarman B. Medium secure forensic psychiatry services: Comparison of seven English health regions. The British Journal of Psychiatry [Internet]. 2001 [cited 2023 Jun 29];178(1):55–61. Available from: https://www.cambridge.org/core/journals/the-british-journal-of-psychiatry/article/medium-secure-forensic-psychiatry-services/FAA935128D172ED97AD6F15545222C92

28. Stürner L, Ross T, Querengässer J, Traub HJ. Institutional influence on length of stay in German forensic hospitals: a multilevel analysis of patients with schizophrenia spectrum disorders. Front Psychiatry. 2024;15:1456363.

29. Connell C, Seppänen A, Scarpa F, Gosek P, Heizman J, Furtado V. External factors influencing length of stay in forensic services: A European evaluation. Psychiatr Pol [Internet]. 2019 [cited 2024 Dec 6];53(3):673–89. Available from: https://researchportal.helsinki.fi/files/127697115/ENGver673Connell_PsychiatrPol2019v53i3.pdf

30. Páv M, Skřivánková P, Wiseman C, Vňuková M, Blatníková Š, Hollý M. Forensic Treatment Services in the Czech Republic: Current State and Future Challenges. Int J Forensic Ment Health [Internet]. 2020 Jul 2 [cited 2021 Jul 7];19(3):269–82. Available from: https://www.tandfonline.com/doi/abs/https://doi.org/10.1080/14999013.2020.1732505

31. Sebalo I, Sebalo Vňuková M, Anders M, Ptáček R, Páv M. Markers of predicting discharge from forensic psychiatric hospitals in Czechia. https://doi.org/101177/00207640241255575 [Internet]. 2024 Jun 6 [cited 2024 Oct 8]; Available from: https://journals.sagepub.com/doi/full/10.1177/00207640241255575

32. Pav M, Skrivankova P. Analysis of forensic mental health care in the Czech Republic – current state and challenges. Eur Psychiatry [Internet]. 2019;56S(S3–S444):190. Available from: http://2019.epa-congress.org/2019/abstracts/abstract-book-2019#.XU2sNl4zbyM

33. Páv M, Vňuková M, Papežová S, Toman J, ÚSTAVNÍ OCHRANNÁ LÉČENÍ V. ČR 2018–2020 INPATIENT FORENSIC TREATMENT IN THE CZECH REPUBLIC 2018–2020. Čes Slov Psychiatr. 2022;118(1):9–16.

34. Páv M, Sebalo I, Vňuková M, Pabiánová Š, Málová V, Hollý M, et al. Predicting discharge from long-term forensic treatment: patients characteristics, protective factors, needs and treatment-related factors study in the Czechia. J Forensic Psychiatry Psychol. 2022;33(1):89–111.

35. Páv M, Sebalo I, Brichcín S, Perkins D. Outcome Evaluation of a Treatment Program for Men with Paraphilic Disorders Convicted of Sexual Offenses: 10-Year Community Follow-up. https://doi.org/101177/0306624X231165416 [Internet]. 2023 May 9 [cited 2023 Aug 3]; Available from: https://journals.sagepub.com/doi/abs/https://doi.org/10.1177/0306624X231165416

36. Efron B, Tibshirani RJ. A introduction to the Bootstrap. Boca Raton: Chapman & Hall, 1993.; 1993. 436 p.

37. Sebalo I, Sebalo Vňuková M, Anders M, Ptáček R, Páv M. Markers of predicting discharge from forensic psychiatric hospitals in Czechia. https://doi.org/101177/00207640241255575 [Internet]. 2024 Jun 6 [cited 2024 Dec 6]; Available from: https://journals.sagepub.com/doi/full/10.1177/00207640241255575

38. Páv M, Vňuková M, Sebalo I. Factors Affecting Length of Inpatient Forensic Stay: Retrospective Study From Czechia. Front Psychiatry [Internet]. 2022 May 4 [cited 2022 Jun 26];13. Available from: /pmc/articles/PMC9114463/.

39. Tomlin J, Lega I, Braun P, Kennedy HG, Herrando VT, Barroso R et al. Forensic mental health in europe: some key figures. Soc Psychiatry Psychiatr Epidemiol. 2020.

40. Senn D, Bulten E, Tomlin J, Völlm B. A comparison of english and Dutch Long-Stay patients in forensic psychiatric care. Front Psychiatry. 2020;11:574247.

41. Weber K, Morier S, Lesaffre L, Menu C, Bertschy P, Herrmann FR, et al. Court-ordered inpatient psychiatric care in switzerland: determinants of length of stay and treatment outcome. Front Psychiatry. 2023;14:1222337.

42. Lau S, Brackmann N, Mokros A, Habermeyer E. Aims to reduce coercive measures in forensic inpatient treatment: A 9-Year observational study. Front Psychiatry. 2020;11.

43. Farrell C, Brink J. The prevalence and factors associated with antipsychotic polypharmacy in a forensic psychiatric sample. Front Psychiatry. 2020;11:517071.

44. O'Neill C, Kelly A, Sinclai H, Kennedy H, Deprivation. Different implications for forensic psychiatric need in urban and rural areas. Soc Psychiatry Psychiatr Epidemiol [Internet]. 2005 Aug 15 [cited 2025 Mar 17];40(7):551–6. Available

from: https://link.springer.com/article/https://doi.org/10.1007/s00127-005-0919-9

45. Fett AKJ, Lemmers-Jansen ILJ, Krabbendam L. Psychosis and urbanicity: a review of the recent literature from epidemiology to neurourbanism. Curr Opin Psychiatry [Internet]. 2019 May 1 [cited 2025 Mar 17];32(3):232–41. Available from: https://pubmed.ncbi.nlm.nih.gov/30724751/

46. Losert C, Schmauß M, Becker T, Kilian R. Area characteristics and admission rates of people with schizophrenia and affective disorders in a German rural catchment area. Epidemiol Psychiatr Sci [Internet]. 2012 Dec [cited 2025 Mar 17];21(4):371–9. Available from: https://www.cambridge.org/core/journals/epidemiology-and-psychiatric-sciences/article/abs/area-characteristics-and-admission-rates-of-people-with-schizophrenia-and-affective-disorders-in-a-german-rural-catchment-area/BF7E1CA6A4C56276977DA6C5920DE052

47. Seppänen A, Törmänen I, Shaw C, Kennedy H. Modern forensic psychiatric hospital design: Clinical, legal and structural aspects [Internet]. Vol. 12, International Journal of Mental Health Systems. BioMed Central Ltd.; 2018 [cited 2021 May 17]. pp. 1–12. Available from: https://link.springer.com/articles/https://doi.org/10.1186/s13033-018-0238-7

48. Andreasson H, Nyman M, Krona H, Meyer L, Anckarsäter H, Nilsson T, et al. Predictors of length of stay in forensic psychiatry: the influence of perceived risk of violence. Int J Law Psychiatry. 2014;37(6):635–42.

49. Gosek P, Kotowska J, Rowińska-Garbień E, Bartczak D, Heitzman J. Treatment resistance and prolonged length of stay among schizophrenia inpatients in forensic institutions. Psychiatry Res. 2021;298:113771.

50. Taylor JL, Novaco RW, Brown T. Reductions in aggression and violence following cognitive behavioural anger treatment for detained patients with intellectual disabilities. Journal of Intellectual Disability Research [Internet]. 2016 Feb 1 [cited 2024 Dec 6];60(2):126–33. Available from: https://onlinelibrary.wiley.com/doi/full/https://doi.org/10.1111/jir.12220

51. Klapilová K, Demidova LY, Elliott H, Flinton CA, Weiss P, Fedoroff JP. Psychological treatment of problematic sexual interests: cross-country comparison. https://doi.org/101080/0954026120191591353 [Internet]. 2019 Feb 17 [cited 2022 Jul 22];31(2):169–80. Available from: https://www.tandfonline.com/doi/abs/https://doi.org/10.1080/09540261.2019.1591353

52. Taxman FS, Smith L. Risk-Need-Responsivity (RNR) classification models: still evolving. Aggress Violent Behav. 2021;59:101459.

53. Etzler S, Eher R, Rettenberger M. Dynamic Risk Assessment of Sexual Offenders: Validity and Dimensional Structure of the Stable-2007. Assessment [Internet]. 2020 Jun 1 [cited 2025 Mar 18];27(4):822–39. Available from: https://journals.sagepub.com/doi/full/10.1177/1073191118754705

54. Lösel F, Link E, Schmucker M, Bender D, Breuer M, Carl L et al. On the Effectiveness of Sexual Offender Treatment in Prisons: A Comparison of Two Different Evaluation Designs in Routine Practice. Sexual Abuse: Journal of Research and Treatment [Internet]. 2020 Jun 1 [cited 2022 Jun 6];32(4):452–75. Available from: http://journals.sagepub.com/doi/10.1177/1079063219871576

55. Lösel F, Schmucker M. The effectiveness of treatment for sexual offenders: A comprehensive meta-analysis. Journal of Experimental Criminology 2005 1:1 [Internet]. 2005 Apr [cited 2022 Jan 8];1(1):117–46. Available from: https://link.springer.com/article/10.1007/s11292-004-6466-7

56. Schmucker M, Lösel F. The effects of sexual offender treatment on recidivism: an international meta-analysis of sound quality evaluations. J Exp Criminol. 2015;11(4):597–630.

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