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The Swiss Prison Study (SWIPS): Results from a registry-based study of prisoners in Switzerland from 2015 to 2020

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Summary

AIM OF THE STUDY: The purpose of the present study was to evaluate demographic characteristics of inmates in the Canton of Zurich (exposure), and investigate the changes in diseases and drug use between 2015 and 2020 (outcome).

METHODS: The study prospectively evaluated 51,989 inmates admitted to the Police Prison Zurich in Switzerland between 1 April 2015 and 31 August 2020 and who were systematically medically assessed. A total of 19,027 (37%) inmates had one or more health conditions, which the authors recorded according to the International Classification of Diseases-10 (ICD-10), in addition to demographic data (country of origin, sex, age, year of imprisonment), as well as details of any drugs used (type and dosage).

RESULTS: The 19,027 inmates with medical conditions had a mean age of 35.4±12.5 years (range 10–89) and comprised 16,489 males (87%). The inmates originated from 170 countries, including 4606 from Switzerland (24.2%), 4227 from Eastern Europe (22%) and 3432 from the Middle East & North Africa (18%). A total of 1631 inmates (9%) were enrolled in the medication-assisted treatment (MAT) programme, and 672 patients (4%) received a psychiatric evaluation. The proportions of foreign prisoners did not increase during the study period. There was a significant increase in the use of antipsychotics from year 1 to 5 ($y = 0.866x$; $R^2 = 0.902$; $p = 0.01$) and anticonvulsants from year 1 to 4 ($y = 1.27x$; $R^2 = 0.823$; $p = 0.01$), and a significant decrease in the use of analgesics from year 2 to 5 ($y = -4.42x$; $R^2 = 0.947$; $p = 0.03$) and antianxiety drugs from year 1 to 4 ($y = -3.31x$; $R^2 = 0.989$; $p = 0.005$). Inmates from Switzerland were most likely to use antianxiety drugs, while inmates from the Middle East & North Africa were most likely to use antipsychotics (OR 2.09; CI 1.88–2.34) and anticonvulsants (OR 3.52; CI 2.90–4.29), whereas inmates from Latin and North America were most likely to use herbal medicine (OR 1.50; CI 1.05–2.10).

CONCLUSIONS: The findings of this study could help anticipate needs of prisons as well as improve treatment of disease and assist with substance use or abuse, particularly in the context of migration.

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Introduction

In 2021, more than 10.7 million people were held in penal institutions worldwide either as pre-trial inmates or having been convicted and sentenced [1]. Inmates are particularly vulnerable as they tend to be socially disadvantaged and have more health conditions, especially in low- and middle-income countries [2, 3]. Mental health conditions such as psychosis and major depression can occur in up to 27% of inmates, while substance use disorders including addiction to illegal drugs, pharmaceuticals or alcohol occur in up to 41%, which could exacerbate the transmission of blood-borne diseases [4]. Studies have shown that prisoners tend to have a higher prevalence of health problems compared to individuals of the same age, race and sex in free society [5].

Substance abuse and mental health conditions are prevalent health conditions in Swiss prisons, as reported by Moschetti et al. [6] and Wolff et al. [7] To address these issues, medication-assisted treatment (MAT) programmes have been successfully implemented in prison since 1975, providing substitution therapy to inmates in need. The objectives of these programmes are to reduce mortality, improve inmates' overall health, prevent the transmission of infections and improve quality of life [8, 9]. Currently, in Switzerland, 18,000 people benefit from MAT with methadone or buprenorphine and 1600 people are eligible to receive heroin-assisted treatment (HAT) such as diacetylmorphine (pharmaceutical heroin), whereby drugs are given in combination with counselling and behavioural treatments to help patients recover from their addiction [10]. Furthermore, the use of new psychoactive substances (NPS) increased incredibly in Europe between 2008 and 2015 [11, 12].

The EU immigration crisis in 2015 resulted in over one million people seeking refuge in Europe, compared to only

200,000 in the previous year, creating unprecedented challenges [11–13]. Little is known about the impact of the crisis on the inmate population, particularly in countries with a high proportion of foreign inmates, such as Switzerland. Since 1999, the proportion of foreign inmates in Swiss prisons has varied from 69% to 74.3% [13]. In 2021, 70.8% of the 6316 inmates in Swiss prisons were foreigners, whereas the average percentage of foreign inmates in the EU was 15% [13, 14].

The purpose of the present study was to evaluate changes in the age, sex and country of origin of inmates (exposure) in the Canton of Zurich, and to investigate the changes in diseases and drug use between 2015 and 2020 (outcome). Information on correlation of drug use and diseases, as well as temporal and demographic changes could help anticipate needs of prisons as well as improve treatment of disease and reduce substance use or abuse.

Material and methods

The authors prospectively assessed the entire population of 51,989 inmates who were admitted to the Police Prison Zurich (PPZ) in Switzerland between 1 April 2015 and 31 August 2020. All inmates of the Canton of Zurich are detained for a maximum of 7 days, and thereafter transferred to a pre-trial detention centre or a long-term facility to serve a sentence, or deported based on the Aliens Act. All inmates were assessed by the authors (TG, NM, PB, MM) following the protocol [15], and their medical records were anonymised and saved in the registry. A total of 19,027 (37%) inmates had one or more health conditions, which the authors (TG, NM, PB, MM) recorded according to the International Classification of Diseases-10 (ICD-10), in addition to demographic data (country of origin, sex, age, year of imprisonment) which were obtained from the police, as well as details of any drugs used (type and dosage), which were self-declared by inmates when they arrived at the prisonand after they were seen by a physician (i.e. baseline). The medical diagnosis was based on the inmates' case history, self-reported information and, when necessary, additional medical tests. Additional information included evidence of a traumatic injury at admission and participation in the MAT programme. This study followed the STROBE reporting guidelines [16].

Data collection and management

The process of data entry into the health registry followed the protocol [15] and involved a team of physicians who reviewed the source documents and entered the data into a unique electronic case report form. All source documents had to be placed in the prisoner's medical history, and incomplete or unclear data were made apparent in the registry. After data entry, completeness and plausibility checks were conducted by the data manager, and the encrypted database was periodically backed up using external hard drives to ensure security.

Quality control

The quality control was performed in accordance with the protocol [15], and consisted of four parts:

1. Interobserver variability: The source documentation of 150 random patients was processed by two physicians (NM, TG).

2. Matching with a local database from the jurisdiction: Data from the health registry were compared with data from the jurisdiction, and discrepancies (e.g. country of origin) were further investigated by the study team.

3. Internal validity: The consumption of medications was summarised for each month from 2015 to 2020, and these data were compared with the prescription data collected from the PPZ's local pharmacy, which collects monthly data for all dispensed medications. This step ensures that the medication actually dispensed is equal to the medication prescribed.

4. Verification of the source documents: Foreign health-related documents were checked and, if necessary, translated into German by a recognised body (e.g. translation services). In the case of an already established course of pharmaceutical drug treatment with dispensing category A+ as defined by article 24 of the Federal Act on Medicinal Products and Medical Devices (Therapeutic Products Act), e.g. opioids, benzodiazepines, methylphenidate, required external verification of the original prescription and a statement from the physician. Written verifications by the federal authorities or nongovernmental organisations involved in the opioid replacement therapy programme were also accepted.

Ethics approval and consent to participate

This study was approved by the ethics committee of the Canton of Zurich (IRB#: KEK-ZH No. 2019-01055) and was conducted in accordance with the protocol (https://doi.org/10.2196/23973 [15]) and the principles enshrined in the current version of the Declaration of Helsinki, Good Clinical Practice guidelines issued by the International Conference on Harmonization and the requirements of Swiss Law and Swiss regulatory authorities. In accordance with article 34 of the Swiss Human Research Act, the need to obtain informed consent was waived for this study, and data were collected from all prisoners.

Statistical analysis

Descriptive statistics were used to summarise the data. The Shapiro-Wilk test was used to verify normality of distributions. For the five drug classes (analgesics, antipsychotics, antianxiety drugs, anticonvulsants and herbal medicine) with the greatest variation in usage, a general linear model was performed to evaluate trends in usage over the studied time period. Diagnostic tests confirmed linearity and homoscedasticity based on residuals. Furthermore, uni- and multi-variable logistic regression analyses were performed on the same five drug classes to determine associations in terms of odds ratios with four independent variables (age, sex, year of observation and country of origin). Models were deemed sufficiently powered, considering the recommendations of Austin and Steyerberg of two subjects per variable [17]. Depending on data distribution, an independent samples t-test or the Mann–Whitney U test was used to compare independent samples. P values <0.05 were considered significant. A Bonferroni correction was applied to adjust for multiple testing to compare inmates on MAT vs

remaining inmates. Statistical analyses were performed using R, version 4.1 (R Foundation for Statistical Computing).

Results

Validation of quality control

Altogether, 14,268 source documents were available. Inter-observer variability from 150 medical records resulted in a correlation coefficient of 0.980 (95% CI 0.978–0.982) for demographic variables and 0.975 (95% CI 0.969–0.981) for drugs, suggesting high reliability. Cross-referencing medical records with the jurisdictional database further confirmed the data's high reliability, with 99.9% of demographic variables aligning and 93.1% of all medications being accurately documented. The 7% variance in drug records compared to the jurisdictional database primarily arose from on-demand medications noted in medical charts but not consistently sourced from the pharmacy.

Demographics

The 19,027 inmates with medical conditions had a mean age of 35.4±12.5 years (range 10–89) and comprised 16,489 males (87%) (table 1). The inmates originated from 170 countries, including 4606 from Switzerland (24.2%), 4227 from Eastern Europe (22%) and 3432 from the Middle East & North Africa (18%). A total of 1631 inmates (9%) were enrolled in the MAT programme and 672 patients (4%) received a psychiatric evaluation. The proportion of inmates from Switzerland increased slightly between year 1 (24%) and year 5 (28%), and the proportion of inmates from Eastern Europe slightly decreased between year 1 (25%) and year 5 (20%); the proportion of inmates from the other regions remained unchanged.

Diseases

Of the inmates with medical conditions, 66% had 1–3 conditions, 26% had 4–6 conditions and 8% had 7 or more conditions. A total of 59,794 conditions were recorded and grouped into 26 categories according to ICD-10 codes, the most common of which were "Mental, behavioural and neurodevelopmental disorders" (54% of inmates; Class F), "Symptoms, signs and abnormal clinical and laboratory findings" (21% of inmates; Class R), "Diseases of the digestive system" (18% of inmates; Class K) and "Diseases of the nervous system" (17% of inmates; Class G). Considering the three most common diseases in each ICD-10 class (table 2), the most prevalent infectious diseases were HIV, hepatitis C and mycoses, and the most prevalent mental, behavioural and neurodevelopmental disorders were due to alcohol (14%), severe stress (14%) or opioids (14%).

Specific medical conditions

A total of 1779 inmates (9.3%) reported injuries (50% contusions, 28% wounds and 15% fractures), and 718 inmates (3.8%) had blood alcohol concentration measured (0.14%±0.05). Of all injured prisoners, the head and neck were the most commonly affected body parts (568 or 31.9%), followed by the upper extremity (516, 29.0%), lower extremity (490, 27.5%) and torso (205, 11.5%). A total of 115 inmates (0.6%) were identified as body packers (individuals trafficking drugs within their body). Of the 2494 female inmates with health conditions, 113 were pregnant (4.5%) when admitted to prison, 2 arrived with a newborn baby and 5 arrived with an infant child. During the 5-year period, 5 inmates died (3 suicides, 1 natural death, 1 unknown cause) and 32 attempted suicide (27 by strangulation, 3 by self-inflicted wounds, 1 by self-immolation and 1 by swallowing a foreign object).

Drug use

All inmates with medical conditions used one or more drugs while detained, with 74% using 1–2 drugs, 21% using 3–5 drugs and 5% using 6 or more drugs. A total of 39,673 ever-uses of drugs were recorded, with drugs grouped into 19 categories, the most common of which were analgesics (29% of inmates), antianxiety drugs (20% of inmates) and antipsychotics (16% of inmates). Observing changes in drug use over the 5-year study period revealed an increase in use of antipsychotics, anticonvulsants and herbal medicine and a decrease in use of analgesics and antianxiety drugs.

Inmates on MAT had a mean age of 39.1±8.9 years and the remaining inmates had a mean age of 35.1±12.7 years (table 3). Nearly all inmates on MAT were using analgesics (97%), over half were using antianxiety drugs (57%), while almost a quarter were using antipsychotics (24%). The proportion of inmates on MAT was greatest among those from Switzerland (17%) and Western Europe (12%), and lowest among those from Latin & North America (1.2%) and Sub-Saharan Africa (0.7%) (table 4). The proportion of inmates on MAT was higher for those using 6 or more drugs (28%), as well as for those using 3–5 drugs (17%), compared to those using 1–2 drugs (4.9%) (table 5).

Trends in drug usage (multivariable logistic regression analysis)

The odds of using analgesics were higher in older inmates (OR 1.02; CI 1.01–1.02; p <0.001) and lower for females (OR 0.87; CI 0.79–0.96; p = 0.004) (table 6); they decreased from year 2 to year 5 ($y = -4.42x$; $R^2 = 0.947$; p = 0.03) (table 7). Compared to inmates from Switzerland, inmates from the six other regions were less likely to use analgesics, notably those from Latin and North America (OR 0.45; CI 0.38–0.54; p <0.001) and Sub-Saharan Africa (OR 0.55; CI 0.48–0.63; p <0.001).

The odds of using antipsychotics were marginally higher in younger inmates (OR 0.99; CI 0.99–0.99; p <0.001) and lower for females (OR 0.54; CI 0.47–0.62; p <0.001) (table 6); they increased from year 1 to year 5 ($y = 0.866x$; $R^2 = 0.902$; p = 0.01) (table 7). Compared to inmates from Switzerland, inmates from the Middle East & North Africa were most likely to use antipsychotics (OR 2.20; CI 1.98–2.45; p <0.001) and inmates from Sub-Saharan Africa were less likely to use antipsychotics (OR 0.43; CI 0.35–0.52; p <0.001).

Table 1:
Demographics of the inmates, and stratification by year. The percentages are calculated by dividing the number of observations by the total inmates (total inmates and year by year).

		Inmates (n = 19,027 patients)	**Year 1 (n = 3212)**	**Year 2 (n = 3797)**	**Year 3 (n = 3976)**	**Year 4 (n = 3954)**	**Year 5 (n = 4088)**
Age (years at baseline): mean ±SD		35.4 ± 12.5	36.2 ± 12.2	35.5 ± 12.1	34.9 ± 12.7	35.4 ± 12.6	35.4 ± 12.8
Age (years at baseline): range		(10–89)					
Sex, n (%)	Male	16,489 (87%)	2736 (85%)	3349 (88%)	3524 (89%)	3409 (86%)	3471 (85%)
	Female	2494 (13%)	470 (15%)	448 (12%)	450 (11%)	532 (13%)	594 (15%)
	Missing	*44 (0.2%)*	*6 (0.2%)*	*0 (0%)*	*2 (0.1%)*	*13 (0.3%)*	*23 (0.6%)*
Country (sovereign state according to the United Nations, passport)	Switzerland	4606 (24%)	661 (21%)	896 (24%)	955 (24%)	937 (24%)	1157 (28%)
	Western Europe (WE)	1757 (9.2%)	304 (9.5%)	329 (8.7%)	347 (8.7%)	368 (9.3%)	409 (10%)
	Eastern Europe (EE)	4227 (22%)	795 (25%)	850 (22%)	936 (24%)	830 (21%)	816 (20%)
	Latin & North America (LA & NA)	843 (4.4%)	127 (4.0%)	174 (4.6%)	190 (4.8%)	159 (4.0%)	193 (4.7%)
	Middle East + North Africa (MENA)	3432 (18%)	510 (16%)	747 (20%)	623 (16%)	774 (20%)	778 (19%)
	Sub-Saharan Africa (SSA)	1510 (7.9%)	272 (8.5%)	326 (8.6%)	329 (8.3%)	289 (7.3%)	294 (7.2%)
	Asia & Oceania (OC)	861 (4.5%)	135 (4.2%)	154 (4.1%)	158 (4.0%)	216 (5.5%)	198 (4.8%)
	Missing	*1791 (9.4%)*	*408 (13%)*	*321 (8%)*	*438 (11%)*	*381 (9.6%)*	*243 (5.9%)*
Medication-Assisted Treatment (MAT)		1631 (8.6%)	271 (8.4%)	412 (11%)	366 (9%)	353 (8.9%)	229 (5.6%)
Inmates needing to consult a psychiatrist during imprisonment		672 (3.5%)	146 (4.5%)	240 (6.3%)	47 (1.2%)	48 (1.2%)	191 (4.7%)
Number of drugs used per patient	1–2	14,015 (74%)	2322 (72%)	2649 (70%)	2981 (75%)	2969 (75%)	3094 (76%)
	3–5	4065 (21%)	726 (23%)	951 (25%)	818 (21%)	777 (20%)	793 (19%)
	≥6	947 (5.0%)	164 (5.1%)	197 (5.2%)	177 (4.5%)	208 (5.3%)	201 (4.9%)
Drug categories (as per Federal Act on Medicinal Products and Medical Devices)	Analgesics	5440 (29%)	997 (31%)	1362 (36%)	1133 (28%)	1061 (27%)	887 (22%)
	Antianxiety	3783 (20%)	823 (26%)	886 (23%)	765 (19%)	631 (16%)	678 (17%)
	Antipsychotics	2970 (16%)	431 (13%)	578 (15%)	622 (16%)	626 (16%)	713 (17%)
	Antacids	2421 (13%)	406 (13%)	496 (13%)	485 (12%)	574 (15%)	460 (11%)
	Antidepressants	1785 (9.4%)	313 (10%)	365 (10%)	361 (9.1%)	378 (10%)	368 (9.0%)
	Antihypertensives	1370 (7.2%)	206 (6.4%)	266 (7.0%)	295 (7.4%)	295 (7.5%)	308 (7.5%)
	Antiarrhythmics & Betablockers	651 (3.4%)	99 (3.1%)	143 (3.8%)	142 (3.6%)	147 (3.7%)	120 (2.9%)
	Antibiotics	722 (3.8%)	119 (3.7%)	138 (3.6%)	155 (3.9%)	168 (4.2%)	142 (3.5%)
	Anticoagulants & Thrombolytics	779 (4.1%)	138 (4.3%)	146 (3.8%)	149 (3.7%)	173 (4.4%)	173 (4.2%)
	Anticonvulsants	957 (5.0%)	92 (2.9%)	93 (2.4%)	180 (4.5%)	252 (6.4%)	340 (8.3%)
	Antivirals	466 (2.4%)	53 (1.7%)	79 (2.1%)	99 (2.5%)	118 (3.0%)	117 (2.9%)
	Bronchodilators	731 (3.8%)	125 (3.9%)	197 (5.2%)	114 (2.9%)	159 (4.0%)	136 (3.3%)
	Cholesterol medications	492 (2.6%)	89 (2.8%)	97 (2.6%)	79 (2.0%)	105 (2.7%)	122 (3.0%)
	Gastrointestinal	488 (2.6%)	102 (3.2%)	134 (3.5%)	89 (2.2%)	89 (2.3%)	74 (1.8%)
	Herbal medicine	678 (3.6%)	55 (1.7%)	104 (2.7%)	99 (2.5%)	235 (5.9%)	185 (4.5%)
	Hypoglycaemics	753 (4.0%)	126 (3.9%)	156 (4.1%)	173 (4.4%)	150 (3.8%)	148 (3.6%)
	Sleeping	966 (5.1%)	142 (4.4%)	232 (6.1%)	180 (4.5%)	212 (5.4%)	200 (4.9%)
	Vitamins & Supplements	1219 (6.4%)	236 (7.3%)	277 (7.3%)	259 (6.5%)	211 (5.3%)	236 (5.8%)
	Others	7832 (41%)	1338 (42%)	1417 (37%)	1677 (42%)	1565 (40%)	1835 (45%)
Number of diseases diagnosed per patient	1–3	12,561 (66%)	2091 (65%)	2346 (62%)	2845 (72%)	2633 (67%)	2646 (65%)
	4–6	4916 (26%)	870 (27%)	1104 (29%)	926 (23%)	990 (25%)	1026 (25%)
	≥7	1550 (8.1%)	251 (7.8%)	347 (9.1%)	205 (5.2%)	331 (8.4%)	416 (10%)
Number of diseases diagnosed (International Classification of Diseases, ICD-10)	E – Endocrine, nutritional and metabolic diseases	2327 (12%)	*416 (13%)*	*513 (14%)*	481 (12%)	434 (11%)	483 (12%)
	F – Mental, behavioural and neurodevelopmental disorders	10,282 (54%)	1760 (55%)	1987 (52%)	2125 (53%)	2135 (54%)	2275 (56%)
	G – Diseases of the nervous system	3325 (17%)	535 (17%)	713 (19%)	583 (15%)	696 (18%)	798 (20%)
	I – Diseases of the circulatory system	2282 (12%)	366 (11%)	445 (12%)	462 (12%)	486 (12%)	523 (13%)
	J – Diseases of the respiratory system	2837 (15%)	506 (16%)	676 (18%)	502 (13%)	612 (15%)	541 (13%)
	K – Diseases of the digestive system	3392 (18%)	577 (18%)	691 (18%)	649 (16%)	805 (20%)	670 (16%)
	M – Diseases of the musculoskeletal system and connective tissue	2283 (12%)	418 (13%)	505 (13%)	420 (11%)	477 (12%)	463 (11%)
	R – Symptoms, signs and abnormal clinical and laboratory findings	3922 (21%)	659 (21%)	841 (22%)	719 (18%)	758 (19%)	945 (23%)
	S – Injury, poisoning and certain other consequences of external causes	1591 (8.4%)	240 (7.5%)	294 (7.7%)	291 (7.3%)	373 (9.4%)	393 (10%)

	Z – Factors influencing health status and contact with health services	1904 (10%)	273 (8.5%)	264 (7.0%)	504 (13%)	310 (7.8%)	553 (14%)
	Others (<2%; A, B, C, D, H, L, N, O, P, Q, T, U, V, W, X, Y)	2845 (15%)	487 (15%)	512 (13%)	550 (14%)	621 (16%)	675 (17%)

The odds of using antianxiety drugs were marginally higher in older inmates (OR 1.01; CI 1.01–1.02; p <0.001) (table 6); they decreased from year 1 to year 4 (y = –3.31x; R^2 = 0.989; p = 0.005) (table 7). Compared to inmates from Switzerland, inmates from the six other regions were less likely to use antianxiety drugs, notably those from Sub-Saharan Africa (OR 0.19; CI 0.16–0.24; p <0.001).

The odds of using anticonvulsants were marginally higher in younger inmates (OR 0.99; CI 0.99–1.00; p <0.001) and lower for females (OR 0.41; CI 0.31–0.53; p <0.001) (table 6); it increased from year 1 to year 4 (y = 1.27x; R^2 = 0.823; p = 0.01) and tripled in year 5 (OR 3.08; CI 2.44–3.91; p <0.001) (table 6). Compared to inmates from Switzerland, inmates from the Middle East & North Africa were more likely to use anticonvulsants (OR 3.65; CI 3.02–4.43; p <0.001) and inmates from Latin and North America were less likely to use anticonvulsants (OR 0.48; CI 0.27–0.81; p = 0.009).

The odds of using herbal medicine were higher for females (OR 1.45; CI 1.18–1.77; p <0.001) (table 6); there was no

Table 2:
The three most prevalent diseases diagnosed in each ICD-10 category.

International Classification of Diseases (ICD) categories		N events	% *
B – Viral diseases			
	B20: Human immunodeficiency virus (HIV) disease	486	(2.6%)
	B18: Chronic viral hepatitis C	258	(1.4%)
	B36: Other superficial mycoses	89	(0.5%)
E – Endocrine, nutritional and metabolic diseases			19027
	E11: Type 2 diabetes mellitus	826	(4.3%)
	E51: Thiamine deficiency	622	(3.3%)
	E78: Disorders of lipoprotein metabolism and other lipidaemias	502	(2.6%)
F – Mental, behavioural and neurodevelopmental disorders			
	F10: Mental and behavioural disorders due to use of alcohol	2733	(14.4%)
	F43: Reaction to severe stress and adjustment disorders	2646	(13.9%)
	F11: Mental and behavioural disorders due to use of opioids	2630	(13.8%)
G – Diseases of the nervous system			
	G47: Sleep disorders	2639	(13.9%)
	G40: Epilepsy	593	(3.1%)
	G26: Extrapyramidal and movement disorders in diseases	67	(0.4%)
I – Diseases of the circulatory system			
	I10: Essential (primary) hypertension	1801	(9.5%)
	I25: Chronic ischaemic heart disease	586	(3.1%)
	I50: Heart failure	300	(1.6%)
J – Diseases of the respiratory system			
	J45: Asthma	851	(4.5%)
	J30: Vasomotor and allergic rhinitis	524	(2.8%)
	J06: Acute upper respiratory infections	476	(2.5%)
K – Diseases of the digestive system			
	K21: Gastro-oesophageal reflux disease	2447	(12.9%)
	K08: Other disorders of teeth and supporting structures	493	(2.6%)
	K29: Acute haemorrhagic gastritis	381	(2.0%)
M – Diseases of the musculoskeletal system and connective tissue			
	M54: Dorsalgia	1042	(5.5%)
	M25: Other joint disorders	526	(2.8%)
	M79: Other soft tissue disorders	435	(2.3%)
R – Symptoms, signs and abnormal clinical and laboratory findings			
	R52: Acute pain	1144	(6.0%)
	R51: Headache	1016	(5.3%)
	R07: Pain in throat and chest	470	(2.5%)
S – Injury, poisoning and certain other consequences of external causes			
	S40: Contusion of shoulder and upper arm	161	(0.8%)
	S61: Open wound of wrist and hand	159	(0.8%)
	S60: Superficial injury of wrist and hand	158	(0.8%)
Z – Factors influencing health status and contact with health services			
	Z00: General medical examination	732	(3.8%)
	Z76: Healthy person accompanying sick person	648	(3.4%)
	Z34: Supervision of normal pregnancy	133	(0.7%)

* Percentage and chart correspond to the number of inmates with a specific ICD category divided by the total number of inmates of this study (n = 19,027)

increase or decrease in linearity over the observed years ($y = 1.24x$; $R^2 = 0.741$; $p = 0.140$) (table 7). Compared to inmates from Switzerland, inmates from Latin and North America were more likely to use herbal medicine (OR 1.49; CI 1.05–2.08; p = 0.022) and inmates from Sub-Sa-

Table 3:
Demographics and characteristics of inmates on medication-assisted treatment (MAT) vs inmates not on MAT. The percentages are calculated by dividing the number of observations by the total inmates (those on MAT or remaining inmates).

		Inmates on MAT (n = 1631)	Remaining inmates (n = 17,396)	p value
Age (years at baseline), mean ± SD		39.1 ± 8.9	35.1 ± 12.7	*<0.001*
Sex, n (%)				*0.099*
	Male	1435 (88%)	15,054 (87%)	
	Female	192 (12%)	2302 (13%)	
	Missing	*4 (0.2%)*	*40 (0.2%)*	
Country (sovereign state according to the United Nations, passport), n (%)				*<0.001*
	Switzerland	775 (48%)	3831 (22%)	
	Western Europe (WE)	204 (13%)	1553 (8.9%)	
	Eastern Europe (EE)	299 (18%)	3928 (23%)	
	Latin & North America (LA & NA)	10 (0.6%)	833 (4.8%)	
	Middle East + North Africa (MENA)	144 (8.8%)	3288 (19%)	
	Sub-Saharan Africa (SSA)	11 (0.7%)	1499 (8.6%)	
	Asia & Oceania (OC)	47 (2.9%)	814 (4.7%)	
	Missing	*141 (8.6%)*	*1650 (9.5%)*	
Inmates who consulted a psychiatrist while detained		69 (4.2%)	603 (3.5%)	*0.122*
Number of drugs used per patient, n (%)				*<0.001*
	1–2	691 (42%)	13,324 (77%)	
	3–5	678 (42%)	3387 (19%)	
	≥6	262 (16%)	685 (3.9%)	
Drug categories (as per Federal Act on Medicinal Products and Medical Devices), n (%)	Analgesics	1577 (97%)	3863 (22%)	*<0.001*
	Antianxiety	930 (57%)	2853 (16%)	*<0.001*
	Antipsychotics	388 (24%)	2582 (15%)	*<0.001*
	Antacids	206 (13%)	2215 (13%)	*0.938*
	Antidepressants	265 (16%)	1520 (8.7%)	*<0.001*
	Antihypertensives	74 (4.5%)	1296 (7.4%)	*<0.001*
	Antiarrhythmics & Betablockers	28 (1.7%)	623 (3.6%)	*<0.001*
	Antibiotics	59 (3.6%)	663 (3.8%)	*0.735*
	Anticoagulants & Thrombolytics	57 (3.5%)	722 (4.2%)	*0.215*
	Anticonvulsants	98 (6.0%)	859 (4.9%)	*0.066*
	Antivirals	86 (5.3%)	380 (2.2%)	*<0.001*
	Bronchodilators	62 (3.8%)	669 (3.8%)	*0.929*
	Cholesterol medications	16 (1.0%)	476 (2.7%)	*<0.001*
	Gastrointestinal	57 (3.5%)	431 (2.5%)	*0.017*
	Herbal medicine	15 (0.9%)	662 (3.8%)	*<0.001*
	Hypoglycaemics	26 (1.6%)	727 (4.2%)	*<0.001*
	Sleeping	139 (8.5%)	827 (4.8%)	*<0.001*
	Vitamins & Supplements	219 (13%)	1000 (5.7%)	*<0.001*
	Others	287 (18%)	7545 (43%)	*<0.001*
Number of diseases diagnosed per patient, n (%)				*<0.001*
	1–3	509 (31%)	12,052 (69%)	
	4–6	720 (44%)	4196 (24%)	
	≥7	402 (25%)	1148 (6.6%)	
E – Endocrine, nutritional and metabolic diseases		249 (15%)	2078 (12%)	*<0.001*
F – Mental, behavioural and neurodevelopmental disorders		1630 (100%)	8652 (50%)	*<0.001*
G – Diseases of the nervous system		307 (19%)	3018 (17%)	*0.134*
I – Diseases of the circulatory system		134 (8.2%)	2148 (12%)	*<0.001*
J – Diseases of the respiratory system		165 (10%)	2672 (15%)	*<0.001*
K – Diseases of the digestive system		259 (16%)	3133 (18%)	*0.033*
M – Diseases of the musculoskeletal system and connective tissue		108 (6.6%)	2175 (13%)	*<0.001*
R – Symptoms, signs and abnormal clinical and laboratory findings		192 (12%)	3730 (21%)	*<0.001*
S – Injury, poisoning and certain other consequences of external causes		41 (2.5%)	1550 (8.9%)	*<0.001*
Z – Factors influencing health status and contact with health services		36 (2.2%)	1868 (11%)	*<0.001*
Others (<2%; A, B, C, D, H, L, N, O, P, Q, T, U, V, W, X, Y)		270 (17%)	2575 (15%)	*0.059*

haran Africa were less likely to use herbal medicine (OR 0.64; CI 0.44–0.92; p = 0.019).

Discussion

The main findings of the present study were that while the proportions of foreign prisoners did not increase during the study period, there was a significant increase in use of antipsychotics (OR 1.29), anticonvulsants (OR 2.91) and herbal medicine (OR 2.68) and a significant decrease in use of analgesics (OR 0.60) and antianxiety drugs (OR 0.54). Inmates from Switzerland were most likely to use antianxiety drugs; inmates from the Middle East & North Africa were most likely to use antipsychotics (OR 2.09) and anticonvulsants (OR 3.52); inmates from Latin and North America were most likely to use herbal medicine (OR 1.50). These findings could help anticipate needs of prisons as well as improve treatment of disease and reduce substance use or abuse, particularly in the context of migration.

In the present study, 37% of inmates had one or more health conditions and were using at least one analgesic (29%), antianxiety drug (20%) or antipsychotic (16%). The significant increase in the use of anticonvulsants and antipsychotics is of particular interest as these two categories include some of the new psychoactive substances (NPS), such as quetiapine and alprazolam (antipsychotics) and pregabalin (anticonvulsant). An NPS is defined as "a new

Table 4:
Inmates on medication-assisted treatment (MAT) per country/region of origin.

Country	n	%*	Total inmates
Switzerland	775	17%	3831
Western Europe (WE)	204	12%	1553
Eastern Europe (EE)	299	7.1%	3928
Latin & North America (LA & NA)	10	1.2%	833
Middle East + North Africa (MENA)	144	4.2%	3288
Sub-Saharan Africa (SSA)	11	0.7%	1499
Asia & Oceania (OC)	47	5.5%	814
* The percentage corresponds to the number of inmates on MAT of each country divided by the total number of inmates of that same country.			

Table 5:
Drug usage of inmates on medication-assisted treatment (MAT).

Number of drugs used per inmate	n	%	Total drugs used
1–2	691	4.9%	13,324
3–5	678	17%	3387
≥6	262	28%	685
* The percentage corresponds to the number of inmates on MAT of each drug-use category divided by the total number of inmates of that same category			

Table 6:
Multivariable logistic regression analyses of the five most prevalent drugs and the association with four independent variables. Sample size for each drug category is determined by the number of times each drug was prescribed. P-values reported using likelihood ratio tests: *, p <0.05; **, p <0.001.

	Analgesics			Antipsychotics			Antianxiety			Anticonvulsants			Herbal medicine		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Age (increment for each year of age)	1.01	(1.01–1.02)	*<0.001*	1.00	(0.99–1.00)	*0.090*	1.01	(1.01–1.01)	*<0.001*	1.00	(0.99–1.00)	*0.157*	1.00	(0.99–1.01)	*0.147*
Sex			*0.250*			*<0.001*			*0.646*			*<0.001*			*0.002*
Male	REF			REF			REF			REF			REF		
Female	0.89	(0.80–0.99)		0.66	(0.57–0.77)		1.08	(0.96–1.21)		0.50	(0.37–0.67)		1.42	(1.14–1.76)	
Observation year			*<0.001*			*0.006*			*<0.001*			*<0.001*			*<0.001*
Year 1	REF			REF			REF			REF			REF		
Year 2	1.26	(1.13–1.40)		1.08	(0.93–1.25)		0.88	(0.78–0.99)		0.78	(0.57–1.06)		1.55	(1.10–2.20)	
Year 3	0.88	(0.79–0.98)		1.17	(1.01–1.35)		0.68	(0.60–0.76)		1.52	(1.16–2.01)		1.42	(1.00–2.02)	
Year 4	0.80	(0.72–0.89)		1.14	(0.99–1.32)		0.52	(0.46–0.60)		2.16	(1.67–2.81)		3.46	(2.55–4.78)	
Year 5	0.60	(0.54–0.67)		1.29	(1.12–1.48)		0.54	(0.48–0.61)		2.91	(2.28–3.76)		2.68	(1.97–3.72)	
Country (sovereign state according to the United Nations, passport)			*<0.001*			*<0.001*			*<0.001*			*<0.001*			*0.507*
Switzerland	REF			REF			REF			REF			REF		
Western Europe (WE)	0.79	(0.70–0.90)		0.63	(0.53–0.75)		0.67	(0.58–0.76)		1.14	(0.85–1.53)		1.04	(0.77–1.39)	
Eastern Europe (EE)	0.86	(0.79–0.94)		0.61	(0.54–0.70)		0.52	(0.47–0.58)		1.51	(1.22–1.88)		1.19	(0.96–1.49)	
Latin & North America (LA & NA)	0.45	(0.37–0.54)		0.82	(0.66–1.01)		0.31	(0.25–0.38)		0.53	(0.29–0.89)		1.50	(1.05–2.10)	
Middle East + North Africa (MENA)	0.68	(0.62–0.76)		2.09	(1.88–2.34)		0.62	(0.55–0.69)		3.52	(2.90–4.29)		1.06	(0.83–1.35)	
Sub-Saharan Africa (SSA)	0.58	(0.50–0.66)		0.43	(0.34–0.52)		0.20	(0.16–0.24)		0.52	(0.34–0.79)		0.66	(0.45–0.95)	
Asia & Oceania (OC)	0.73	(0.61–0.86)		0.49	(0.38–0.63)		0.37	(0.29–0.45)		0.56	(0.32–0.90)		0.64	(0.39–1.01)	

Table 7:
Linearity of the five most prevalent drugs and the association with four independent variables.

	Analgesics			Anti-psychotics			Antianxiety			Anticonvulsants			Herbal medicine		
	y =	R		y =	R		y =	R		y =	R		y =	R	
Observation year	–4.42	0.95	*0.030*	0.87	0.90	*0.010*	–3.31	0.99	*0.005*	1.27	0.82	*0.010*	1.24	0.74	*0.140*

narcotic or psychotropic drug, in pure form or in preparation, that is not controlled by the United Nations drug conventions, but which may pose a public health threat comparable to that posed by substances listed in these conventions" by the European Monitoring Centre for Drugs and Drug Addiction. Prescription medications like quetiapine, alprazolam and pregabalin are not inherently classified as NPS, though they could also be considered as prescription drugs subject to misuse. However, analysis of medical records reveals that these drugs were frequently employed as tailored substitutes for NPS within correctional facilities, considering factors such as patient profiles and dosage. Regrettably, the particular category of NPS falls outside the scope of this study. Psychoactive substances, including synthetic drugs or designer drugs, are a complex and diverse group of substances designed to mimic established illicit drugs, such as cannabis, cocaine, MDMA and LSD. Unlike illicit drugs, NPS are easily available on the internet and fairly low-priced, making them popular and dangerous substances [18]. The trends observed corroborate the recent findings of the European Monitoring Centre of Drugs and Drug Addiction, which also reported a rapid increase in the number, type and availability of NPS in Europe [11]. Overall, the available literature suggests an important clinical abuse of NPS while their mechanisms are not fully understood [19, 20]. In the Swiss prison context, Wolff et al. [7] reported that 40% of the 2195 inmates were using illicit drugs, while Moschetti et al. [6] reported that 41% of the 1664 inmates had self-declared substance-abuse problems with illegal drugs, pharmaceuticals or alcohol.

In the present study, we observed a significant decrease in use of analgesics from 36% to 22% following a similar downward trend reported by Dart et al. [21] from 2011 to 2013 in the US. Even though the study period of the present study does not overlap with that of Dart et al. [21], the downward trend is due to the increasing number of local, state and federal government programmes to improve opioid prescription with guidelines and educational initiatives, as well as a decrease in supply and demand.

Our findings show that there are trends in correlation between country of origin and type of drug used. Information about these trends is of high importance in countries like Switzerland that have a mainly migrant population and MAT programmes. Unexpected variations in the inmate population may lead to drug stock shortage or excess inventory disrupting the delivery of the necessary drugs to inmates, which eventually impacts the results of the programme. In the context of the immigration crisis, precise knowledge of temporal and demographic changes could help anticipate needs of prisons as well as reduce substance use. The proven benefits of MAT to individuals and society have been demonstrated by several studies [8, 9, 22]. Libenz et al. [9] found no evidence for increased mortality, overdoses or severe medical complications after the introduction of HAT for incarcerated opioid-using individuals in a Swiss open prison. In contrast, Binswanger et al. [23] reported an elevated risk of fatal overdoses linked to the loss of tolerance for opioids during incarceration, in combination with a lack of psychoeducation about the consequences of resumption of opioid use. Degenhardt et al. [24] found lower post-release mortality among inmates who continued opioid substitution therapy (OST) compared to those who did not continue OST.

Limitations

The findings of this study should be interpreted with the following limitations in mind. First, grouping data into general categories may have hidden specific results. Given the substantial amount of data, the need to group drugs, health conditions and countries in order to summarise our findings prevented us from noticing specific trends for specific countries or drugs. Second, the chosen categories and classification of health conditions used in the present study do not allow direct comparison with all previous studies. Third, the authors did not include diseases in the regression analysis model since there are direct relationships between diseases and medications required to treat the disease, which would result in high collinearity. Fourth, the authors are aware that there might be bias due to underreporting or missing data, which could be due to language barriers, the healthcare system of the country of origin or other reasons. Fifth, this is a substudy of SWIPS, and the focus of the study changed from the protocol, and adapted tofocusing on diseases to drugs due to language barriers. The emphasis on drugs stems from investigators' acknowledgement that the number of patients with comprehensive medical records was overestimated. However, the utilisation of routine medications, coupled with widely accessible medical histories, remains acceptable for determining the health status of inmates, as described in the protocol. Finally, although our study provides valuable insights into drug use patterns and the health condition of inmates, it is important to note that we were unable to compare our data to the general population due to the unavailability of such data, which may limit the generalisability of our findings.

Conclusion

Our assessment of inmates in the Canton of Zurich between 2015 and 2020 revealed that the proportion of Swiss inmates increased, while that of Eastern European inmates decreased. Furthermore, there was a significant increase in use of antipsychotics, anticonvulsants and herbal medicine and a significant decrease in use of antianxiety drugs. Inmates from Switzerland were most likely to use antianxiety drugs, inmates from the Middle East & North Africa were most likely to use antipsychotics and anticonvulsants, whereas inmates from Latin and North America were most likely to use herbal medicine.

Open science

The study was performed in accordance with the previously published protocol [15]. Data are available upon reasonable request from the corresponding author. Code is available upon reasonable request.

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Potential competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest.

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