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Temporal trends in sedative medication use among hospitalised medical patients – a retrospective cohort study

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Summary

INTRODUCTION: Sedative psychopharmacological medications – including antipsychotics, antidepressants and hypnotics/anxiolytics – are frequently used to manage insomnia, agitation and psychiatric symptoms in hospitalised patients. However, their use carries substantial risks, particularly in older and multimorbid populations. This study examined temporal trends in sedative medication prescriptions and compared prescribing patterns from hospital admission to discharge on medical wards.

METHODS: This retrospective cohort study, using electronic health record data from a Swiss tertiary care hospital, studied 31,093 hospitalisations between 2019 and 2022. The primary outcome was quarterly prescribing trends of sedative medications (antipsychotics, antidepressants, and hypnotics, sedatives or anxiolytics) across the study years. Additionally, we explored differences between hospital admission and discharge and examined the proportion of prescriptions linked to a corresponding ICD-10 diagnosis.

RESULTS: From 2019 to 2022, discharge prescriptions increased for antipsychotics (8.4% in 2019 vs 11.7% in 2022, p for trend <0.001), decreased slightly for anxiolytics or sedatives (13.7% vs 12.6%, p = 0.06) and remained stable for antidepressants (13.8% vs 13.8%, p = 0.89). The proportion of patients without any sedative medication prescription decreased both over the study years (77.1% vs 74.8%, p <0.001) and during hospitalisation (77.6% on admission vs 75.7% at discharge, p <0.001). A considerable proportion of patients with a discharge prescription of any sedative medication did not have a corresponding diagnosis, including 50.1% for antipsychotics, 72.5% for antidepressants and 49.6% for anxiolytics or sedatives.

CONCLUSIONS: Sedative medication prescribing at hospital discharge increased over the study period, largely driven by rising antipsychotic use despite declining anxiolytic prescriptions. The frequent absence of a corresponding diagnosis raises concerns about potential overuse and continuation beyond appropriate clinical need. These findings highlight the need for improved prescribing practices, including systematic medication review and stronger use of non-pharmacological alternatives.

Introduction

Psychopharmacological medications with sedative effect have been commonly used to treat insomnia and agitation, particularly in hospitalised patients [1, 2]. While these medications such as antipsychotics, hypnotics or anxiolytics are highly effective in the short term, their use is associated with significant risks, side effects and drug interactions in the long run [1-5]. This is of particular concern in vulnerable populations such as older, multimorbid medical inpatients who are at greater risk of complications like delirium, falls and cognitive decline [6, 7]. Anxiolytics such as

benzodiazepines additionally carry the risk of respiratory depression and the potential for dependency and withdrawal. Similarly, hypnotics are associated with cognitive impairment and a higher risk of delirium in hospitalised patients [8, 9]. Antipsychotics also carry the risk of extrapyramidal symptoms, metabolic disturbances and increased mortality in elderly patients, especially those with dementia [1, 10-13].

To address these challenges, the 2023 Choosing Wisely Switzerland recommendations for internal medicine strongly advise against the continuation of antipsychotics initiated during hospitalisation for agitation or insomnia [14]. This guidance is supported by evidence highlighting the high potential for misuse and the frequent, unjustified continuation of these medications without proper reassessment [15, 16]. This often results in the issue being carried over into the ambulatory sector, further exacerbating the problem [16]. A variety of measures have been taken to reduce the use of sedative medications in the ambulatory setting, especially after hospital discharge [17]. Some of these measures include pharmacist-led medication review, clinical decision support, risk scales or nurse assessment [17-24]. Despite these efforts, ambulatory prescriptions of antipsychotics have shown an increasing trend in recent years [25]. In contrast, ambulatory prescriptions of antidepressants have remained relatively stable over the past decade, while prescriptions of anxiolytics and sedatives have declined, according to a Swiss Health Observatory (Obsan) report [26].

The extent to which prescription patterns among hospitalised patients have responded to interventions aimed at reducing sedative medication overuse remains unclear. It could be hypothesised that these trends mirror those observed in the ambulatory sector; however, hospital-specific interventions may independently influence prescribing behaviour.

This study examined temporal trends in sedative medication prescriptions and compared prescribing patterns from hospital admission to discharge on medical wards, with a secondary goal of identifying risk factors for different sedative medication classes.

Methods

Data source and study design

For this retrospective cohort study, we collected data from the electronic health records of all eligible admissions to the Medical University Clinic at Aarau Cantonal Hospital between January 2019 and December 2022. This data included medication on hospital admission and discharge, inpatient diagnoses and procedures performed, and baseline demographics. All comorbidities and diagnoses are reported as International Statistical Classification of Diseases and Related Health Problems (ICD-10 codes) and procedures as “Schweizerische Operationsklassifikation” (CHOP) codes. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline was followed at all times during this study [27].

Study population

All medical inpatient hospitalisations were included, with the following exclusion criteria: patients who had declined general informed consent; and patients who died during hospitalisation, for whom no discharge medication data was therefore available. We did not apply any further exclusion criteria, thereby allowing for higher generalisability of study results.

Medications of interest and terminology

Sedative medications were categorised into three groups – antipsychotics, antidepressants and hypnotics/sedatives/anxiolytics (henceforth “anxiolytics” – based on the Anatomical Therapeutic Chemical (ATC) classification system, following the categorisation used by Obsan [26]. For the purposes of this study, we use the term “sedative medication” as a pragmatic umbrella term to describe drugs that may exert sedative effects in clinical practice. We acknowledge that such effects are neither uniform across agents nor independent of dose, and that the degree of sedation varies substantially depending on the specific drug and its dosage (e.g. low-dose quetiapine versus other agents with minimal sedative properties). This classification is therefore not intended as a strict pharmacodynamic categorisation but rather as a clinically orientated grouping. We use this terminology for clarity and readability, given the lack of a concise and widely accepted alternative and recognise this as a limitation of our approach.

Outcomes

The primary outcome was defined as the quarterly trends of proportion of patients with sedative medication use at admission and discharge. Secondary outcomes included number of sedative medications and the presence of a corresponding diagnosis.

Baseline characteristics

Baseline patient characteristics were recorded at hospital admission and include sociodemographic data (age, sex, Swiss citizenship, supplemental insurance), admission details (emergency admission, type of hospital) and comorbidities. Comorbidities were identified using ICD-10 codes.

Statistical analysis

We used descriptive statistics to summarise patient characteristics by year of admission. Continuous variables were reported as mean with standard deviation (SD), and categorical variables as count with percentage. The 4-year study period was divided into 16 quarters, each representing a 3-month interval. For each quarter, the proportion of patients receiving a given medication class was calculated based on those admitted during that period.

Prescription trends were visualised using locally weighted polynomial regression (lowess) on quarterly rates. Differences in prescription trends over time were assessed using the Cochran-Armitage test. Changes in prescriptions from admission to discharge were compared using the McNemar test. A Sankey diagram was used to illustrate medication changes during hospitalisation.

We used logistic regression models to identify risk factors for having a prescription for the medication class at discharge. We selected the covariates for the model based on clinical relevance and data availability. All sociodemographic variables available in the dataset were included – namely sex, age (>65), admission from home, supplemental insurance and Swiss citizenship – to capture potential demographic and socioeconomic influences. Comorbidities were additionally included to account for patients' underlying health status and clinical complexity.

Additionally, we conducted subgroup analyses stratified by sex and age (<65 vs ≥65 years).

We further displayed the percentage of patients with sedative medication prescriptions with and without a corresponding diagnosis per year and for each sedative medication class. Diagnoses indicating sedative medication use were defined based on the compendium of psychiatric pharmacotherapy [28], which serves as a decision aid for physicians at Aarau Cantonal Hospital. A list of relevant diagnoses for each sedative medication class is provided in table S1 in the appendix.

All analyses were performed using Stata version 17.0 (StataCorp LLC, College Station, TX, USA). Statistical significance was defined as a two-sided $p < 0.05$, with corresponding 95% confidence intervals (CI).

Ethics approval

Institutional review board approval was provided by the Institutional Review Board of Northwestern Switzerland (EKNZ BASEC Req-2022-00977). This study was conducted according to the principles stated in the Declaration of Helsinki and followed the Strengthening the Reporting of Observational Studies in Epidemiology reporting guidelines [27]. The institutional review board waived the requirement of participant informed consent, due to deidentification of the data and the retrospective nature of the analysis.

Results

Baseline characteristics

We identified 35,832 hospitalisations between January 2019 and December 2022, of which 3124 (8.7%) were excluded due to refusal to grant general consent and 1615 (4.5%) due to missing discharge data following death. Therefore, we included 31,093 (86.8%) hospitalisations for this analysis. The mean age of these patients was 68 and 42.2% were female. Most patients (77.3%) were living at home prior to admission and 80.2% were Swiss citizens. Common comorbidities included cardiovascular disease (33.5%), chronic kidney disease (20.6%), atrial fibrillation (19.7%), type 2 diabetes mellitus (17.5%), cancer (16.8%) and heart failure (11.9%), with prevalence either stable or increasing over time. Mood disorders were the most frequent psychiatric comorbidity (6.5%). The prevalence of mood disorders (6.4% [2019] vs 7.3% [2022], $p = 0.003$), anxiety disorders (3.3% vs

4.5%, p <0.001) and personality disorders (0.5% vs 1.3%, p <0.001) increased over time, while other psychiatric comorbidities remained stable. Detailed baseline characteristics are presented in table 1.

Table 1: Baseline characteristics, overall and by study year.

Characteristics		Overall	2019	2020	2021	2022	p-value
		n = 31,093	n = 7893	n = 7978	n = 8020	n = 7202	
Patient characteristics, n (%)	Female sex	13,128 (42.2%)	3382 (42.8%)	3356 (42.1%)	3375 (42.1%)	3015 (41.9%)	0.62
	Age, mean (SD)	68 (1)	69 (1)	68 (1)	67 (1)	67 (1)	<0.001
	Admission from home	24,033 (77.3%)	6095 (77.2%)	6168 (77.3%)	6185 (77.1%)	5585 (77.5%)	0.93
	Supplemental insurance	5506 (17.7%)	1431 (18.1%)	1395 (17.5%)	1410 (17.6%)	1270 (17.6%)	0.72
	Swiss citizen	24,926 (80.2%)	6489 (82.2%)	6347 (79.6%)	6355 (79.2%)	5735 (79.6%)	<0.001
Somatic comorbidities, n (%)	Myocardial infarction	2668 (8.6%)	725 (9.2%)	630 (7.9%)	619 (7.7%)	694 (9.6%)	<0.001
	Cardiovascular disease	10,420 (33.5%)	2780 (35.2%)	2575 (32.3%)	2500 (31.2%)	2565 (35.6%)	<0.001
	Cancer	5220 (16.8%)	1331 (16.9%)	1348 (16.9%)	1278 (15.9%)	1263 (17.5%)	0.067
	Stroke	2972 (9.6%)	771 (9.8%)	733 (9.2%)	718 (9.0%)	750 (10.4%)	0.011
	Cerebral atherosclerosis	913 (2.9%)	167 (2.1%)	186 (2.3%)	248 (3.1%)	312 (4.3%)	<0.001
	Heart failure	3707 (11.9%)	858 (10.9%)	829 (10.4%)	884 (11.0%)	1136 (15.8%)	<0.001
	Chronic kidney disease	6393 (20.6%)	1695 (21.5%)	1634 (20.5%)	1606 (20.0%)	1458 (20.2%)	0.12
	Diabetes mellitus type 2	5444 (17.5%)	1374 (17.4%)	1377 (17.3%)	1392 (17.4%)	1301 (18.1%)	0.56
	Obstructive sleep apnoea syndrome	924 (3.0%)	236 (3.0%)	219 (2.7%)	233 (2.9%)	236 (3.3%)	0.27
	Atrial fibrillation	6129 (19.7%)	1553 (19.7%)	1557 (19.5%)	1565 (19.5%)	1454 (20.2%)	0.70
	Liver disease	1173 (3.8%)	255 (3.2%)	304 (3.8%)	263 (3.3%)	351 (4.9%)	<0.001
	Pneumonia	3004 (9.7%)	518 (6.6%)	878 (11.0%)	860 (10.7%)	748 (10.4%)	<0.001
	Solid tumour	4055 (13.0%)	1027 (13.0%)	1032 (12.9%)	975 (12.2%)	1021 (14.2%)	0.003
	Haematological tumour	1435 (4.6%)	379 (4.8%)	355 (4.4%)	362 (4.5%)	339 (4.7%)	0.69
Psychiatric comorbidities, n (%)	Mood disorder	2029 (6.5%)	507 (6.4%)	523 (6.6%)	470 (5.9%)	529 (7.3%)	0.003
	Schizophrenia	202 (0.6%)	58 (0.7%)	60 (0.8%)	40 (0.5%)	44 (0.6%)	0.16
	Psychosis	373 (1.2%)	94 (1.2%)	109 (1.4%)	76 (0.9%)	94 (1.3%)	0.077
	Anxiety disorder	1157 (3.7%)	257 (3.3%)	292 (3.7%)	284 (3.5%)	324 (4.5%)	<0.001
	Behavioural syndromes	81 (0.3%)	18 (0.2%)	18 (0.2%)	17 (0.2%)	28 (0.4%)	0.11
	Personality disorder	279 (0.9%)	42 (0.5%)	70 (0.9%)	72 (0.9%)	95 (1.3%)	<0.001
	Intellectual disabilities	103 (0.3%)	23 (0.3%)	31 (0.4%)	23 (0.3%)	26 (0.4%)	0.60
	Dementia	1174 (3.8%)	314 (4.0%)	290 (3.6%)	319 (4.0%)	251 (3.5%)	0.27

Trends in prescriptions of sedative medications from 2019 to 2022

From 2019 to 2022, the proportion of patients discharged with any sedative medication increased from 22.9% to 25.2% (p for trend <0.001), with no significant change at admission (p = 0.08). The proportion prescribed exactly one sedative medication remained stable at both admission (p = 0.54) and discharge (p = 0.19), whereas prescriptions of two or more sedatives increased at admission (p = 0.047) and discharge (p <0.001). Antipsychotic prescriptions increased at both admission and discharge (p <0.001 for both), while antidepressant prescriptions showed no significant change (admission p = 0.82; discharge p = 0.89) and anxiolytics/sedatives demonstrated a non-significant decreasing trend (admission p = 0.17; discharge p = 0.06) (table 2, figure 1).

Table 2: Proportion of hospitalisations with sedative medication prescriptions at hospital admission and discharge, by study year.

Intensity of sedative treatment		Admission (study year)				p for trend 2019–2022	Discharge (study year)				p for trend 2019–2022
		2019	2020	2021	2022		2019	2020	2021	2022	
Number of cases		7893	7978	8020	7202		7893	7978	8020	7202	
Use of any sedative medication, n (%)		1721 (21.8%)	1762 (22.1%)	1820 (22.7%)	1645 (22.8%)	0.08	1805 (22.9%)	1931 (24.2%)	2011 (25.1%)	1815 (25.2%)	<0.001
	1 sedative medication	1188 (69.0%)	1207 (68.5%)	1223 (67.2%)	1108 (67.4%)	0.54	1324 (73.4%)	1386 (71.8%)	1403 (69.8%)	1265 (69.7%)	0.19
	≥2 sedative medications	533 (31.0%)	555 (31.5%)	597 (32.8%)	537 (32.6%)	0.047	481 (26.6%)	545 (28.2%)	608 (30.2%)	550 (30.3%)	<0.001
Sedative medication classes, n (%)	Anxiolytics / sedatives	1004 (12.7%)	1011 (12.7%)	978 (12.2%)	872 (12.1%)	0.17	1078 (13.7%)	1005 (12.6%)	1007 (12.6%)	910 (12.6%)	0.06
	Antipsychotics	566 (7.2%)	666 (8.3%)	665 (8.3%)	636 (8.8%)	<0.001	663 (8.4%)	870 (10.9%)	894 (11.1%)	840 (11.7%)	<0.001
	Antidepressants	1138 (14.4%)	1088 (13.6%)	1146 (14.3%)	1033 (14.3%)	0.82	1093 (13.8%)	1106 (13.9%)	1138 (14.2%)	994 (13.8%)	0.89
No use, n (%)		6172 (78.2%)	6216 (77.9%)	6200 (77.3%)	5557 (77.2%)	0.08	6088 (77.1%)	6047 (75.8%)	6009 (74.9%)	5387 (74.8%)	<0.001

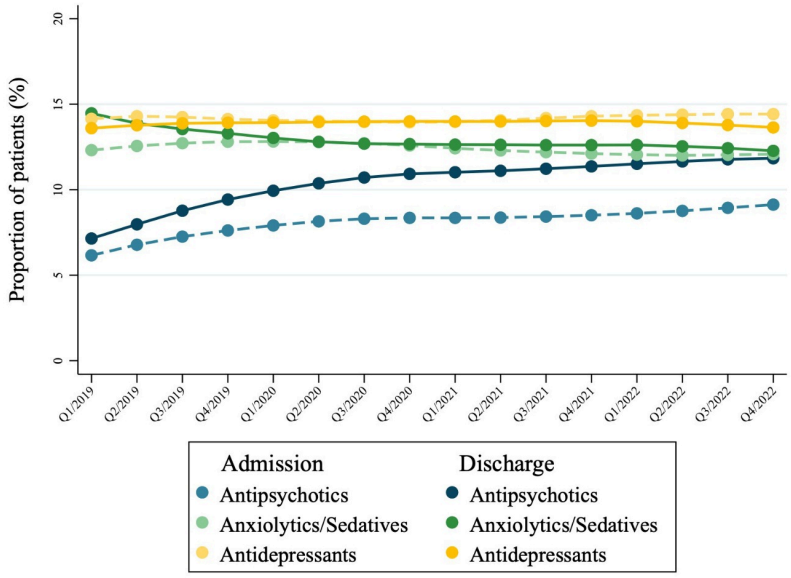


Figure 1: Quarterly trends in sedative medication use at admission and discharge between 2019 and 2022. Locally weighted polynomial regression models (lowess) of proportion of hospitalisations with different categories of sedative medication prescription at admission and discharge.

Prescription trends of sedative medications between admission and discharge

The proportion of patients prescribed at least one sedative medication increased by 2.0% points from admission to discharge (p <0.001) (table 3, figure 2).

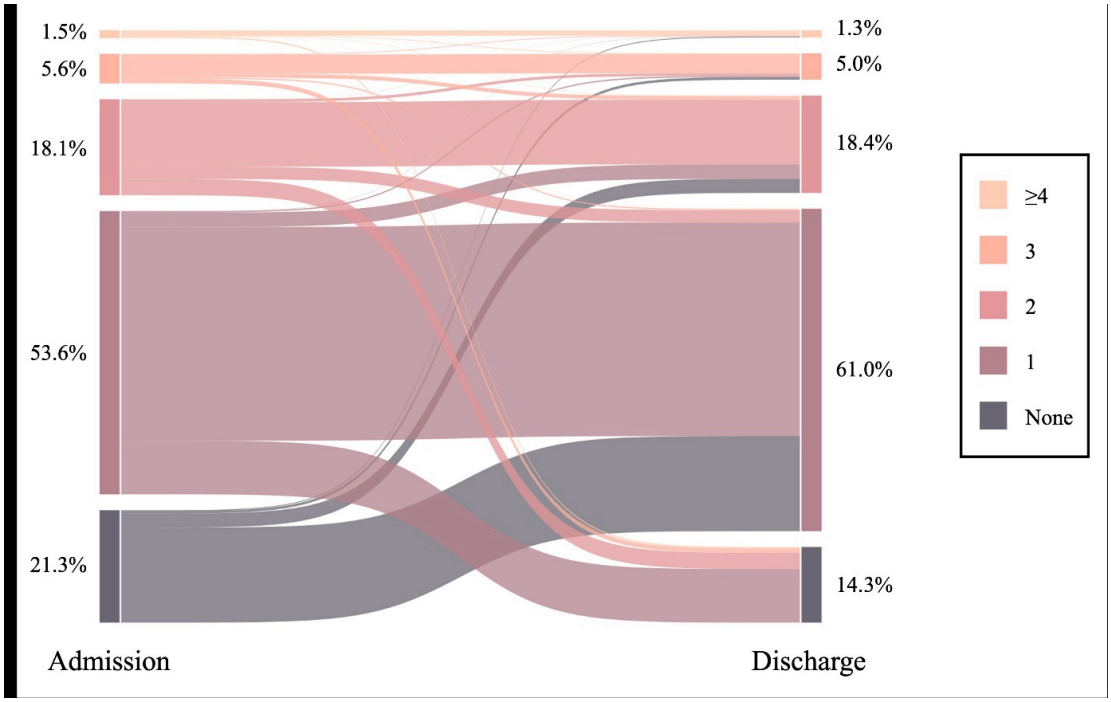


Figure 2: Longitudinal patterns of sedative medication use from admission to discharge. The bars represent the proportions (%) of hospitalisations with or without a certain number of sedative medication at hospital admission (left) and hospital discharge (right).

This change was driven by increases in anxiolytic prescriptions (+0.5%, p = 0.006) and antipsychotic prescriptions (+2.4%, p <0.001), while antidepressant prescriptions showed a borderline decrease (–0.3%, p = 0.05) (table 3).

Table 3: Proportion of hospitalisations with sedative medication prescriptions at hospital admission and discharge, by study year overall and per subgroup.

Medication		Overall		2019		2020		2021		2022	
		Admission (%) / Discharge (%)	p-value	Admission (%) / Discharge (%)	p-value	Admission (%) / Discharge (%)	p-value	Admission (%) / Discharge (%)	p-value	Admission (%) / Discharge (%)	p-value
Overall	Any use	22.3% / 24.3%	<0.001	21.8% / 22.9%	<0.01	22.1% / 24.2%	<0.01	22.7% / 25.1%	<0.01	22.8% / 25.2%	<0.01
	Anxiolytics	12.4% / 12.9%	0.006	12.7% / 13.7%	<0.01	12.7% / 12.6%	0.83	12.2% / 12.6%	0.25	12.1% / 12.6%	0.11
	Antipsychotics	8.1% / 10.5%	<0.001	7.2% / 8.4%	<0.01	8.3% / 10.9%	<0.01	8.3% / 11.1%	<0.01	8.8% / 11.7%	<0.01
	Antidepressants	14.2% / 13.9%	0.050	14.4% / 13.8%	0.02	13.6% / 13.9%	0.36	14.3% / 14.2%	0.72	14.3% / 13.8%	0.04
Age ≥65 years	Any use	23.7% / 25.2%	<0.001	23.1% / 24.3%	<0.01	23.2% / 24.3%	0.01	24.9% / 27.1%	<0.01	23.8% / 25.3%	<0.01
	Anxiolytics	14.1% / 13.5%	0.002	13.9% / 14.0%	0.89	14.5% / 13.0%	<0.01	14.0% / 13.3%	0.10	13.9% / 13.5%	0.39
	Antipsychotics	8.0% / 10.6%	<0.001	7.1% / 9.0%	<0.01	8.0% / 10.1%	<0.01	8.5% / 12.0%	<0.01	8.5% / 11.4%	<0.01
	Antidepressants	14.6% / 14.0%	<0.001	14.9% / 14.0%	<0.01	14.2% / 13.9%	0.42	15.1% / 14.5%	0.10	14.3% / 13.4%	<0.01
Age <65 years	Any use	20.0% / 22.8%	<0.001	19.3% / 20.1%	0.13	20.2% / 24.0%	<0.01	19.3% / 22.0%	<0.01	21.3% / 25.0%	<0.01
	Anxiolytics	9.7% / 11.9%	<0.001	10.4% / 13.0%	<0.01	9.7% / 11.9%	<0.01	9.4% / 11.4%	<0.01	9.2% / 11.2%	<0.01
	Antipsychotics	8.4% / 10.4%	<0.001	7.3% / 7.3%	1.00	8.9% / 12.3%	<0.01	8.0% / 9.8%	<0.01	9.4% / 12.0%	<0.01
	Antidepressants	13.5% / 13.9%	0.031	13.6% / 13.6%	1.00	12.8% / 13.8%	<0.01	13.1% / 13.7%	0.15	14.5% / 14.5%	1.00
Female	Any use	26.9% / 27.8%	0.004	26.3% / 26.6%	0.68	26.1% / 27.0%	0.10	27.8% / 29.4%	<0.01	27.6% / 28.1%	0.46
	Anxiolytics	16.1% / 15.7%	0.151	16.9% / 16.3%	0.23	16.7% / 15.9%	0.09	15.2% / 15.3%	0.77	15.4% / 15.3%	0.85
	Antipsychotics	8.5% / 9.9%	<0.001	8.0% / 8.6%	0.09	7.7% / 9.4%	<0.01	8.8% / 10.9%	<0.01	9.6% / 11.0%	<0.01
	Antidepressants	18.3% / 17.6%	0.002	18.3% / 17.3%	0.01	17.6% / 17.6%	0.94	18.4% / 18.0%	0.38	18.8% / 17.4%	<0.01
Male	Any use	19.0% / 21.8%	<0.001	18.4% / 20.1%	<0.01	19.1% / 22.2%	<0.01	19.0% / 21.9%	<0.01	19.4% / 23.1%	<0.01
	Anxiolytics	9.8% / 10.8%	<0.001	9.6% / 11.7%	<0.01	9.7% / 10.2%	0.20	10.0% / 10.5%	0.22	9.7% / 10.7%	0.02
	Antipsychotics	7.9% / 10.9%	<0.001	6.6% / 8.2%	<0.01	8.8% / 12.0%	<0.01	7.9% / 11.3%	<0.01	8.3% / 12.1%	<0.01
	Antidepressants	11.2% / 11.2%	0.700	11.5% / 11.3%	0.44	10.8% / 11.1%	0.25	11.3% / 11.4%	0.77	11.2% / 11.2%	1.00

Risk factors for sedative medication prescription at discharge

Independent risk factors for antidepressant prescription at discharge included female sex, Swiss citizenship, chronic kidney disease, type 2 diabetes, obstructive sleep apnoea syndrome, liver disease and dementia. Lower odds were observed for age ≥65 years, admission from home, and hospitalisation for myocardial infarction, ischaemic stroke, atrial fibrillation or flutter, or pneumonia (figure S1 in the appendix).

Increased odds of anxiolytic prescription at discharge were associated with female sex, Swiss citizenship, heart failure, chronic kidney disease, obstructive sleep apnoea syndrome, liver disease, solid cancer, haematological malignancy or dementia. Lower odds were observed for admission from home, myocardial infarction, ischaemic stroke and pneumonia (figure S2 in the appendix).

Risk factors for antipsychotic prescription at discharge included heart failure, chronic kidney disease, type 2 diabetes mellitus, solid cancer, haematological malignancy and dementia. Lower odds were found for female sex, age ≥65 years, admission from home, supplemental insurance, cardiovascular disease and pneumonia (figure S3 in the appendix).

Subgroups

Comparison of patients aged <65 and ≥65 years showed more pronounced increasing trends among younger patients. In this group, prescription rates for all medication classes were higher at discharge than at admission, whereas in older patients such an increase was observed only for antipsychotics (table 3). Among younger patients, the increase in antipsychotic prescriptions at discharge was substantial (7.3% in 2019 vs 12.0% in 2022, p for trend <0.001), accompanied by a more marked decline in anxiolytic prescriptions at discharge over time (13.0% vs 11.2%, p for trend = 0.04) (table S2, figure S4 in the appendix).

Across the study period, women had higher prescription rates of anxiolytics and antidepressants than men, while antipsychotic use was similar between sexes. Antipsychotic prescriptions at discharge increased in both men (8.2% in 2019 vs 12.1% in 2022, p for trend <0.001) and women (8.6% vs 11.0%, p for trend <0.001) (table S3, figure S5 in the appendix). During hospitalisation,

men showed marked increases in anxiolytic and antipsychotic prescriptions, whereas antidepressant use remained stable. In women, antipsychotic prescriptions increased, while prescriptions for both antidepressants and anxiolytics declined at discharge compared with admission (table 3).

Prescriptions without a corresponding diagnosis

A considerable proportion of patients discharged with a sedative medication lacked a corresponding diagnosis: 50.1% for antipsychotics, 72.5% for antidepressants and 49.6% for anxiolytics or sedatives. From 2019 to 2022, this proportion decreased for anxiolytics (55.7% to 42.0%) and antidepressants (73.3% to 69.1%), but increased for antipsychotics (43.6% to 49.5%) (figure S6 in the appendix).

Discussion

This study demonstrates a significant increase in prescriptions of sedative medications at discharge over time, largely attributable to increased antipsychotic use, while antidepressant prescribing remained stable and anxiolytic use decreased. Prescriptions at discharge exceeded those at admission, particularly for antipsychotics. Subgroup analyses showed age- and sex-specific differences, with younger patients showing steeper increases in sedative and antipsychotic prescriptions, and female patients more frequently receiving anxiolytics and antidepressants. Importantly, a substantial proportion of patients discharged with sedatives lacked a corresponding diagnosis.

Despite concerted efforts to reduce sedative medication use, discharge prescriptions increased from 22.9% in 2019 to 25.2% in 2022, with significant rises in prescription of multiple sedative medications at both admission and discharge. While interventions and clinical guidelines have successfully decreased anxiolytic prescriptions, the rise in antipsychotic use suggests a possible compensatory shift towards these medications. This trend raises concerns, given the well-documented risks associated with antipsychotics, particularly in older and medically complex populations, including extrapyramidal symptoms, metabolic disturbances and increased mortality [10-13]. A significant change in prescription patterns was observed from hospital admission to discharge. While the proportion of patients prescribed at least one sedative medication increased by 2.0% points at discharge, the most notable increase was in antipsychotic prescriptions, which rose by 2.4% points. This increase in antipsychotic prescriptions at discharge may reflect their use for acute agitation or delirium during hospitalisation, with continuation beyond discharge despite guidelines recommending careful reassessment [14]. Although anxiolytic prescriptions rose slightly during hospitalisation (+0.5%), their overall decline over the study period aligns with broader reduction efforts especially targeting the overuse of benzodiazepines. These trends, however, suggest a potential shift towards antipsychotics as alternative sedatives. Whether such prescriptions represent appropriate short-term management or unnecessary continuation remains uncertain, underscoring the need for systematic medication review and discontinuation when no longer clinically indicated.

Over the study period, the prevalence of psychiatric diagnoses, including mood, anxiety and personality disorders, increased. This rise, however, was not paralleled by higher prescribing of antidepressants or anxiolytics, which remained stable or declined. These divergent trends may reflect a potential shift in treatment strategies. One possible explanation may be the growing emphasis on psychotherapeutic rather than pharmacological treatments. Current guidelines recommend psychotherapy as first-line intervention for mood and anxiety disorders, as well as insomnia, particularly in mild to moderate cases [29, 30]. The rising number of psychiatric consultations in hospital settings supports this shift, suggesting that more patients being offered counselling or behavioural therapy recommendations in place of medication. Our findings indicate that sociodemographic and clinical factors influence sedative medication prescribing at discharge. Female sex, Swiss citizenship and comorbidities such as chronic kidney disease, diabetes, obstructive sleep apnoea and dementia were associated with increased odds of receiving sedative medications at discharge. In contrast, patients admitted from home and those hospitalised for myocardial infarction, stroke, atrial fibrillation or pneumonia had lower odds of receiving these medications. These findings suggest that sedative medication use is more strongly driven by underlying psychiatric and chronic medical conditions than by acute hospitalisation-related stressors. While broadly consistent with prior studies, our results differ in that myocardial infarction was associated with reduced rather than increased prescribing risk for sedative medication [31-35].

Subgroup analyses highlight distinct age- and sex-specific prescribing patterns, underscoring the need for tailored interventions to address differential prescribing trends across demographic groups.

The rise in sedative medication prescriptions at discharge, particularly antipsychotics, calls into question the effectiveness of existing deprescribing strategies. Although Choosing Wisely Switzerland emphasises limiting continuation of newly initiated antipsychotics after hospitalisation [14], our findings suggest these recommendations are not consistently implemented. Apparently, the current clinical focus addresses the reduction of prescription of the increasingly discouraged benzodiazepines, not challenging the root cause but merely changing the pharmacological substance used. Addressing this gap may require not only greater provider awareness of the risks associated with antipsychotic overuse, especially in vulnerable populations, but also system-level interventions such as structured medication reviews, stewardship programmes and integration of deprescribing practices into discharge planning. Our study also revealed a substantial proportion of patients discharged with sedatives despite lacking a documented psychiatric diagnosis. This raises concerns about potential overprescription or insufficient documentation, with risks of dependency and adverse effects [10-13, 36]. Off-label prescribing without clear justification underscores the need to strengthen diagnostic accuracy, ensure appropriate indication and expand access to psychotherapeutic interventions in inpatient settings to reduce unnecessary sedative use [29, 30]. This study has several limitations. First, it is based on retrospective data from a single hospital, which may restrict generalisability. Second, we did not assess medication adherence after discharge, limiting insight into long-term use. Additionally, for any observed associations between clinical characteristics and prescribing patterns, causality cannot be proven. Furthermore, underreporting of ICD-10 diagnoses due to coding issues is possible. Future research should explore drivers of increased antipsychotic prescribing and assess long-term patient outcomes.

Conclusion

In summary, this study highlights a notable increase in sedative medication prescriptions at discharge, largely driven by antipsychotics, despite somewhat successful efforts to reduce benzodiazepine overuse. The findings underscore the need to refine prescribing practices by strengthening diagnostic accuracy, expanding non-pharmacological treatment options and implementing tailored interventions, particularly for vulnerable patient groups. Such measures are essential to ensure safer, more appropriate and goal-concordant use of sedatives in the hospital setting.

Data sharing statement

According to Swiss laws, data sharing is restricted to the country.

Notes

Author contributions: CG, RL and AK designed the study. CG and RL performed the statistical calculations. CG and RL wrote the first draft of the manuscript. TS was responsible for data extraction. All authors reviewed and edited the original draft. CG and RL were responsible for the decision to submit the manuscript. All authors have read and agreed to the published version of the manuscript.

Use of AI: The authors declare that generative artificial intelligence (AI) tools were used to a limited extent to support language editing and improve the clarity and readability of the manuscript. AI was not used for data analysis, interpretation of results, or the generation of scientific content. The authors take full responsibility for the final manuscript.

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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. No potential conflict of interest related to the content of this manuscript was disclosed.

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Appendix

Table S1: List of diagnoses by sedative medication class

Definition	ICD-10 code
Antidepressant	
Depressive disorders	*F32.0/F32.8/F33/F34.1/F53.0*
Bipolar and schizoaffective disorders	*F31/F25.1*
Anxiety and phobic disorders	*F40.0/F40.1/F41.0/F41.1/F42/F93.0/F60.6*
Somatoform and related disorders	*F45/F45.2/F45.41*
Post-traumatic stress disorder	*F43.1*
Eating disorders	*F50*
Pain and related conditions	*M79.7/N94/G54/M54*
Headache and migraine disorders	*G43/G44.2*
Cognitive and organic disorders	*F06.3/F06.7/F06.8*
Substance-related disorders	*F10.2/F17.3*
Irritable bowel syndrome	*K58*
Fatigue and sleep disorders	*G93.3/G47.4*
Reproductive and hormonal disorders	*N95.1/O99.3*
Postpartum depression	*F53.0*
Anxiolytics	
Mental and behavioural disorders due to use of alcohol	*F10*
Mental and behavioural disorders due to use of sedatives or hypnotics: Withdrawal state	*F13.3*
Mood [affective] disorders /Mania	*F30/F31/F32/F33/F34/F38/F39/F06.3/F20.4/F25.1/F41.2/F53.0*
Phobic anxiety disorders	*F40*
Other anxiety disorders /Substance induced anxiety	*F41/F06.4*

Reaction to severe stress, and adjustment disorders	*F43*
Nonorganic sleep disorders and sleep disorders	*G47/F51*
Epilepsie/ Status Epilepticus	*G40/G41*
Restlessness and agitation and nervousness	*R45.0/R45.1*
Schizophrenia/ Psychosis	*F03/F05/F09/F20/F21/F22/F23/F24/F25/F28/F29/F31/F39/F44/F06.2+8/F10.5+7/F11.5+7/F12.5+7/F13.5+7/F14.5+7/F15.5+7/F16.5+7/F17.5+7/F18.5+7/F19.5+7/F30.02/F31.2/F31.5/F32.3/F33.3/F53.1*
Stupor/mutism	*F06.1/F20.2/F30.2/F32.3/F44.2/R40.1*
Extrapyramidal symptoms (EPS)	*G20/G21/G22/G23/G24/G25/G26*
Antipsychotics	
Schizophrenia/ Psychosis	*F03/F05/F09/F20/F21/F22/F23/F24/F25/F28/F29/F31/F39/F44/F06.2+8/F10.5+7/F11.5+7/F12.5+7/F13.5+7/F14.5+7/F15.5+7/F16.5+7/F17.5+7/F18.5+7/F19.5+7/F30.02/F31.2/F31.5/F32.3/F33.3/F53.1*
Depressive and related disorders	*F30/F31/F32/F32.3/F33.3/F34.1*
Autism and tic disorders	*F84/F95*
Intellectual disabilities	*F7*
Dementia-related conditions	*U63/U63.0!/U63.4!*
Obsessive-compulsive and anxiety disorders	*F41/F42*
Personality disorders	*F60.0/F60.1/F60.3/F60.31*
Trichotillomania	*F63.3*
Eating disorders	*F50.0*
Sleep disorders	*F51/G47*
Delirium and organic psychotic conditions	*F00-F09/F05.0/F05.1/F05.8/F05.9/F06.1/F06.2/F06.8/F09*
Substance-related mental and behavioral disorders	*F10-F19*
Alcohol- and substance-induced conditions	*F10.0/F10.4/F10.5/F11.5/F12.0/F12.5/F13.5/F14.0/F14.5/F15.5/F16.5/F17.5/F18.5/F19.5*

Restlessness and agitation	*R45.1*
Neuropsychiatric disorders (incl. Parkinson-related)	*G20-G26*
Huntington's disease	*G10*
Pain syndromes and pain disorders	*R52.-/R52.0/R52.1/R52.2/R52.9*
Nausea and vomiting	*R11*

Table S2: Proportion of hospitalizations with sedative medications prescriptions at hospital admission and discharge, by study year and age group

Intensity of sedative treatment	Admission				p for trend 2019-2022	Discharge				p for trend 2019-2022
	Study year					Study year				
	2019	2020	2021	2022		2019	2020	2021	2022	
Age < 65 years										
Number of Cases	2715	3003	3159	2747		2715	3003	3159	2747	
Use										
Any sedative medication, No. (%)	523 (19.3)	608 (20.2)	609 (19.3)	586 (21.3)	0.14	545 (20.1)	721 (24.0)	695 (22.0)	686 (25.0)	<0.001
Use of 1 sedative medication	350 (66.9)	412 (67.8)	386 (63.4)	378 (64.5)	0.75	398 (73.0)	508 (70.5)	465 (66.9)	475 (69.2)	0.09
Use of ≥2 sedative medications	173 (33.1)	196 (32.2)	223 (36.6)	208 (35.5)	0.054	147 (27.0)	213 (29.5)	230 (33.1)	211 (30.8)	0.00
Sedative medication classes, No. (%)										
Use of Anxiolytics/Sedatives	283 (10.4)	290 (9.7)	298 (9.4)	254 (9.2)	0.14	353 (13.0)	358 (11.9)	360 (11.4)	309 (11.2)	0.04
Use of Antipsychotics	198 (7.3)	267 (8.9)	254 (8.0)	257 (9.4)	0.03	199 (7.3)	368 (12.3)	311 (9.8)	331 (12.0)	<0.001
Use of Antidepressants	369 (13.6)	384 (12.8)	414 (13.1)	397 (14.5)	0.32	368 (13.6)	415 (13.8)	432 (13.7)	398 (14.5)	0.38
No use, No. (%)	2192 (80.7)	2395 (79.8)	2550 (80.7)	2161 (78.7)	0.14	2170 (79.9)	2282 (76.0)	2464 (78.0)	2061 (75.0)	<0.001
Age ≥ 65 years										
Number of Cases	5178	4975	4861	4455		5178	4975	4861	4455	
Use										
Any sedative medication, No. (%)	1198 (23.1)	1154 (23.2)	1211 (24.9)	1059 (23.8)	0.17	1260 (24.3)	1210 (24.3)	1316 (27.1)	1129 (25.3)	0.03
Use of 1 sedative medication	838 (69.9)	795 (68.9)	837 (69.1)	730 (68.9)	0.42	926 (73.5)	878 (72.6)	938 (71.3)	790 (70.0)	0.58
Use of ≥2 sedative medications	360 (30.1)	359 (31.1)	374 (30.9)	329 (31.1)	0.272	334 (26.5)	332 (27.4)	378 (28.7)	339 (30.0)	0.01
Sedative medication classes, No. (%)										
Use of Anxiolytics/Sedatives	721 (13.9)	721 (14.5)	680 (14.0)	618 (13.9)	0.79	725 (14.0)	647 (13.0)	647 (13.3)	601 (13.5)	0.54
Use of Antipsychotics	368 (7.1)	399 (8.0)	411 (8.5)	379 (8.5)	0.01	464 (9.0)	502 (10.1)	583 (12.0)	509 (11.4)	<0.001
Use of Antidepressants	769 (14.9)	704 (14.2)	732 (15.1)	636 (14.3)	0.73	725 (14.0)	691 (13.9)	706 (14.5)	596 (13.4)	0.62
No use, No. (%)	3980 (76.9)	3821 (76.8)	3650 (75.1)	3396 (76.2)	0.17	3918 (75.7)	3765 (75.7)	3545 (72.9)	3326 (74.7)	0.03

Table S3: Proportion of hospitalizations with sedative medications prescriptions at hospital admission and discharge, by study year and sex

Intensity of sedative treatment	Admission				p for trend 2019-2022	Discharge				p for trend 2019-2022
	Study year					Study year				
	2019	2020	2021	2022		2019	2020	2021	2022	
Female										
Number of Cases	3382	3356	3375	3015		3382	3356	3375	3015	
Use										
Any sedative medication, No. (%)	890 (26.3)	877 (26.1)	937 (27.8)	832 (27.6)	0.11	898 (26.6)	907 (27.0)	992 (29.4)	847 (28.1)	0.04
Use of 1 sedative medication	581 (65.3)	592 (67.5)	624 (66.6)	532 (63.9)	0.43	625 (69.6)	632 (69.7)	675 (68.0)	561 (66.2)	0.57
Use of ≥2 sedative medications	309 (34.7)	285 (32.5)	313 (33.4)	300 (36.1)	0.170	273 (30.4)	275 (30.3)	317 (32.0)	286 (33.8)	0.01
Sedative medication classes, No. (%)										
Use of Anxiolytics/Sedatives	572 (16.9)	562 (16.7)	512 (15.2)	465 (15.4)	0.03	550 (16.3)	533 (15.9)	518 (15.3)	461 (15.3)	0.22
Use of Antipsychotics	269 (8.0)	258 (7.7)	298 (8.8)	290 (9.6)	0.01	291 (8.6)	314 (9.4)	368 (10.9)	333 (11.0)	<0.001
Use of Antidepressants	619 (18.3)	590 (17.6)	621 (18.4)	566 (18.8)	0.48	585 (17.3)	592 (17.6)	608 (18.0)	526 (17.4)	0.76
No use, No. (%)	2492 (73.7)	2479 (73.9)	2438 (72.2)	2183 (72.4)	0.11	2484 (73.4)	2449 (73.0)	2383 (70.6)	2168 (71.9)	0.04
Male										
Number of Cases	4511	4622	4645	4187		4511	4622	4645	4187	
Use										
Any sedative medication, No. (%)	831 (18.4)	885 (19.1)	883 (19.0)	813 (19.4)	0.28	907 (20.1)	1024 (22.2)	1019 (21.9)	968 (23.1)	0.00
Use of 1 sedative medication	607 (73.0)	615 (69.5)	599 (67.8)	576 (70.8)	0.86	699 (77.1)	754 (73.6)	728 (71.4)	704 (72.7)	0.19
Use of ≥2 sedative medications	224 (27.0)	270 (30.5)	284 (32.2)	237 (29.2)	0.118	208 (22.9)	270 (26.4)	291 (28.6)	264 (27.3)	<0.001
Sedative medication classes, No. (%)										
Use of Anxiolytics/Sedatives	432 (9.6)	449 (9.7)	466 (10.0)	407 (9.7)	0.69	528 (11.7)	472 (10.2)	489 (10.5)	449 (10.7)	0.20
Use of Antipsychotics	297 (6.6)	408 (8.8)	367 (7.9)	346 (8.3)	0.02	372 (8.2)	556 (12.0)	526 (11.3)	507 (12.1)	<0.001
Use of Antidepressants	519 (11.5)	498 (10.8)	525 (11.3)	467 (11.2)	0.81	508 (11.3)	514 (11.1)	530 (11.4)	468 (11.2)	0.98
No use, No. (%)	3680 (81.6)	3737 (80.9)	3762 (81.0)	3374 (80.6)	0.28	3604 (79.9)	3598 (77.8)	3626 (78.1)	3219 (76.9)	0.00

Predictors	OR (95% CI)
Female sex	1.65 (1.54 to 1.77)
≥65 years old	0.85 (0.79 to 0.92)
Admission from home	0.58 (0.54 to 0.63)
Supplemental insurance	1.05 (0.96 to 1.15)
Swiss citizen	1.15 (1.05 to 1.25)
Myocardial infarction	0.63 (0.54 to 0.73)
Cardiovascular disease	0.97 (0.88 to 1.07)
Stroke	0.80 (0.71 to 0.90)
Cerebral atherosclerosis	0.89 (0.73 to 1.09)
Heart failure	0.97 (0.86 to 1.10)
Chronic kidney disease	1.21 (1.11 to 1.32)
Diabetes type 2	1.37 (1.26 to 1.49)
Obstructive sleep apnea syndrom	2.26 (1.93 to 2.65)
Atrial fibrillation and flutter	0.82 (0.75 to 0.90)
Liver disease	1.51 (1.30 to 1.76)
Pneumonia	0.77 (0.68 to 0.87)
Cancer	1.00 (0.62 to 1.60)
Solid cancer	1.01 (0.64 to 1.60)
Hematological malignancy	0.66 (0.43 to 1.01)
Dementia	1.94 (1.69 to 2.23)

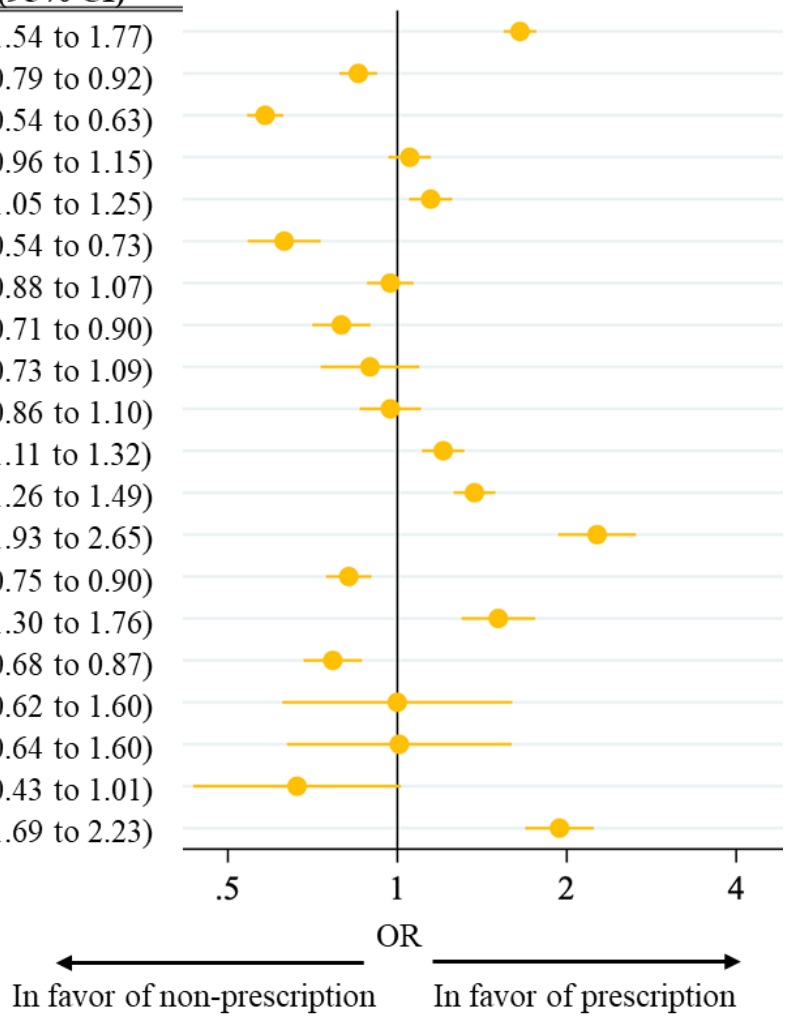


Figure S1: Predictors associated with the prescribing of antidepressants at discharge. Abbreviations: OR, odds ratio

Predictors	OR (95% CI)
Female sex	1.50 (1.40 to 1.61)
≥65 years old	0.99 (0.92 to 1.08)
Admission from home	0.57 (0.53 to 0.61)
Supplemental insurance	1.03 (0.95 to 1.13)
Swiss citizen	1.27 (1.15 to 1.39)
Myocardial infarction	0.74 (0.64 to 0.86)
Cardiovascular disease	0.98 (0.88 to 1.08)
Stroke	0.68 (0.59 to 0.77)
Cerebral atherosclerosis	0.84 (0.68 to 1.05)
Heart failure	1.20 (1.06 to 1.36)
Chronic kidney disease	1.28 (1.17 to 1.39)
Diabetes type 2	0.92 (0.84 to 1.02)
Obstructive sleep apnea syndrom	1.34 (1.11 to 1.62)
Atrial fibrillation and flutter	0.99 (0.90 to 1.08)
Liver disease	1.92 (1.66 to 2.22)
Pneumonia	0.84 (0.75 to 0.95)
Cancer	0.90 (0.64 to 1.25)
Solid cancer	1.73 (1.26 to 2.38)
Hematological malignancy	1.76 (1.31 to 2.36)
Dementia	1.18 (1.01 to 1.39)

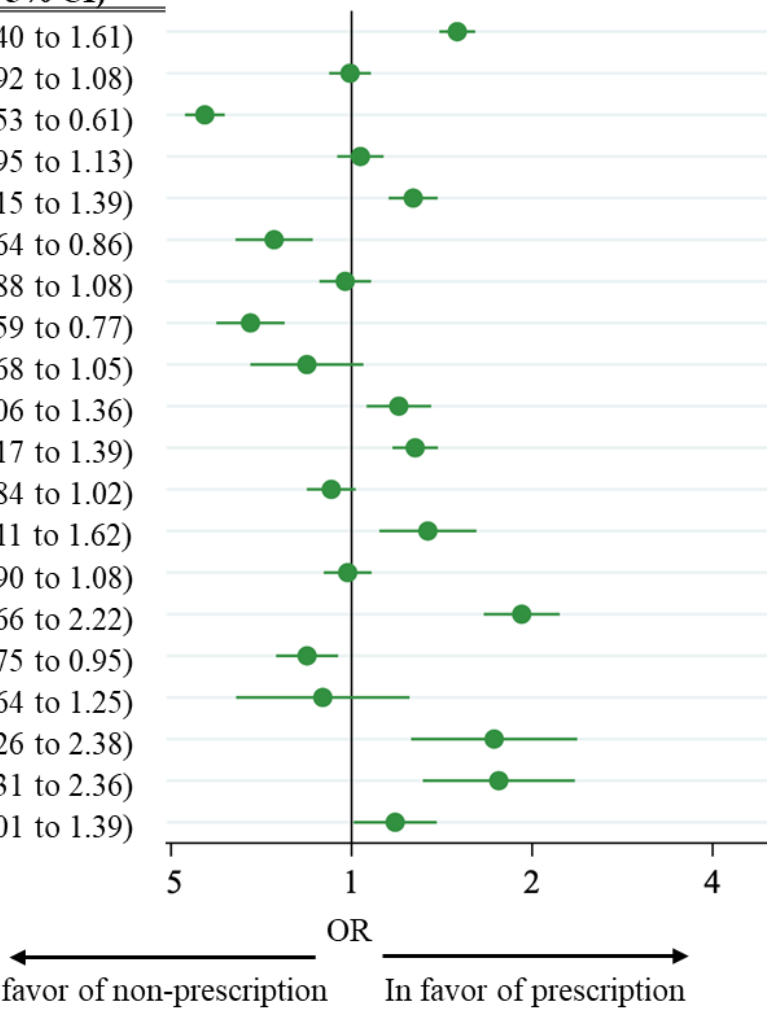


Figure S2: Predictors associated with the prescribing of anxiolytics at discharge. Abbreviations: OR, odds ratio

Predictors	OR (95% CI)
Female sex	0.83 (0.77 to 0.90)
≥65 years old	0.80 (0.73 to 0.87)
Admission from home	0.44 (0.40 to 0.47)
Supplemental insurance	0.87 (0.78 to 0.97)
Swiss citizen	1.07 (0.97 to 1.18)
Myocardial infarction	0.88 (0.74 to 1.04)
Cardiovascular disease	0.71 (0.63 to 0.79)
Stroke	0.89 (0.78 to 1.02)
Cerebral atherosclerosis	1.18 (0.95 to 1.46)
Heart failure	1.32 (1.14 to 1.53)
Chronic kidney disease	1.22 (1.11 to 1.35)
Diabetes type 2	1.19 (1.07 to 1.31)
Obstructive sleep apnea syndrom	1.00 (0.80 to 1.25)
Atrial fibrillation and flutter	0.98 (0.89 to 1.09)
Liver disease	1.12 (0.94 to 1.35)
Pneumonia	0.81 (0.71 to 0.92)
Cancer	1.16 (0.84 to 1.60)
Solid cancer	2.34 (1.72 to 3.19)
Hematological malignancy	1.96 (1.49 to 2.58)
Dementia	4.70 (4.10 to 5.39)

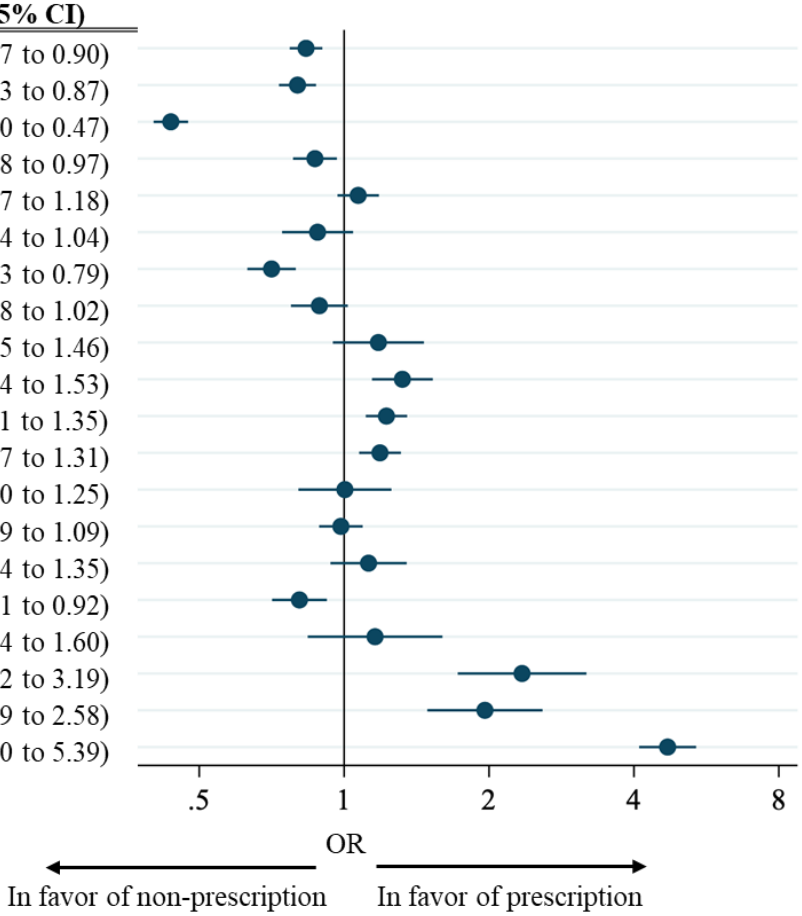


Figure S3: Predictors associated with the prescribing of antipsychotics at discharge. Abbreviations: OR, odds ratio

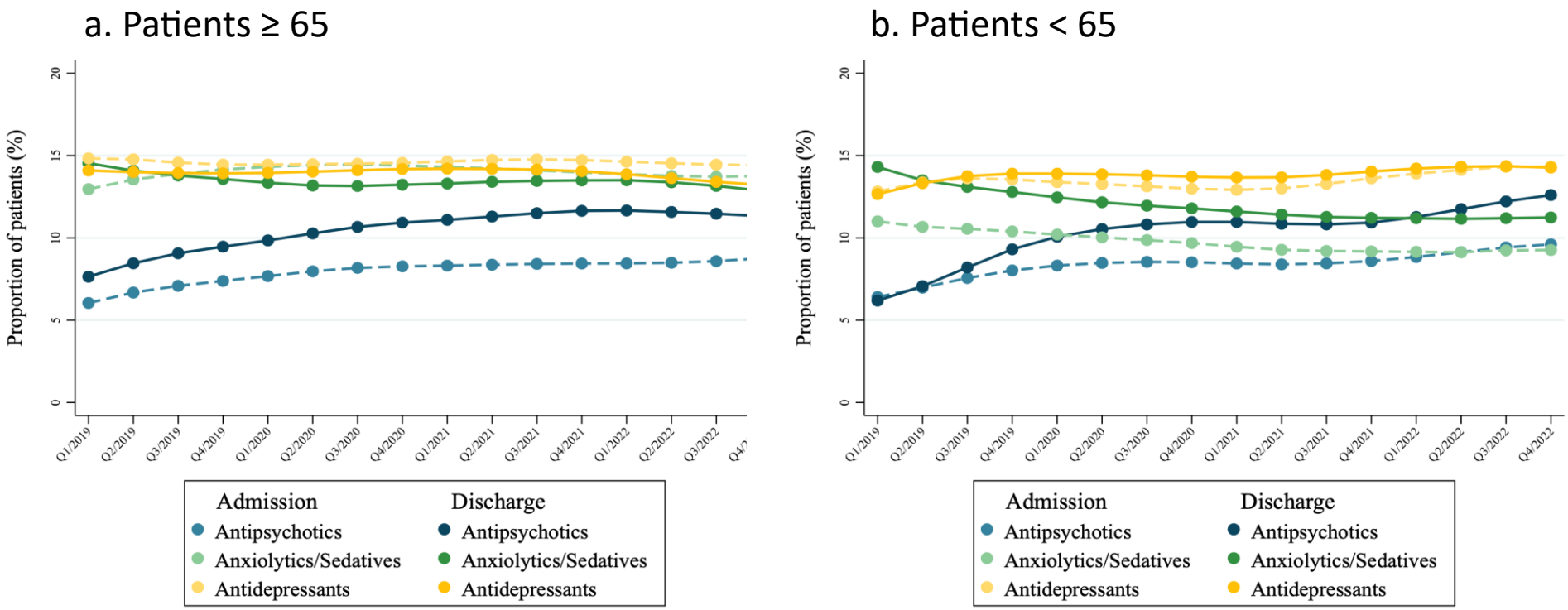


Figure S4: Quarterly trends in sedative medication use at admission and discharge between 2019 and 2022, by age group

Locally weighted polynomial regression models (lowess) of proportion of hospitalizations with diffent cateegories of sedative medication prescription at admission and discharge.

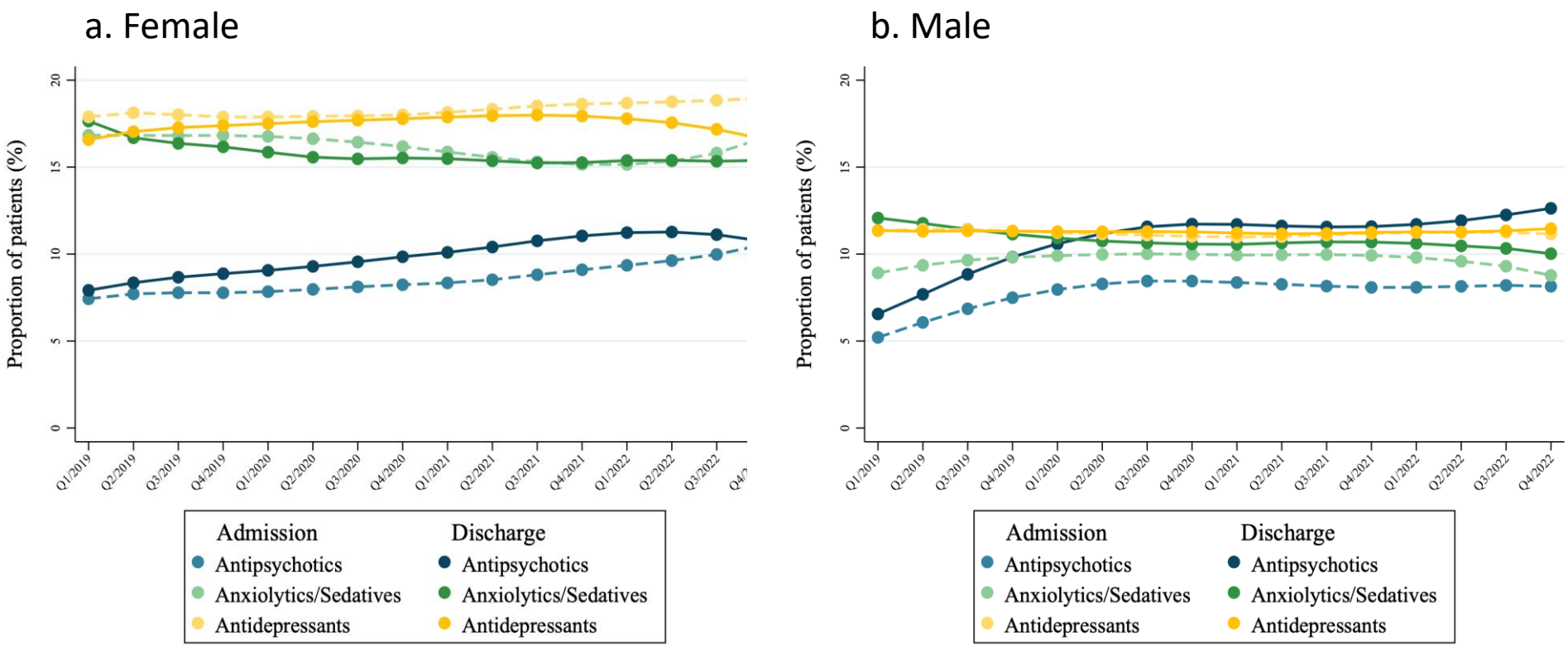


Figure S5: Quarterly trends in sedative medication use at admission and discharge between 2019 and 2022, by sex

Locally weighted polynomial regression models (lowess) of proportion of hospitalizations with diffent cateegories of sedative medication prescription at admission and discharge.

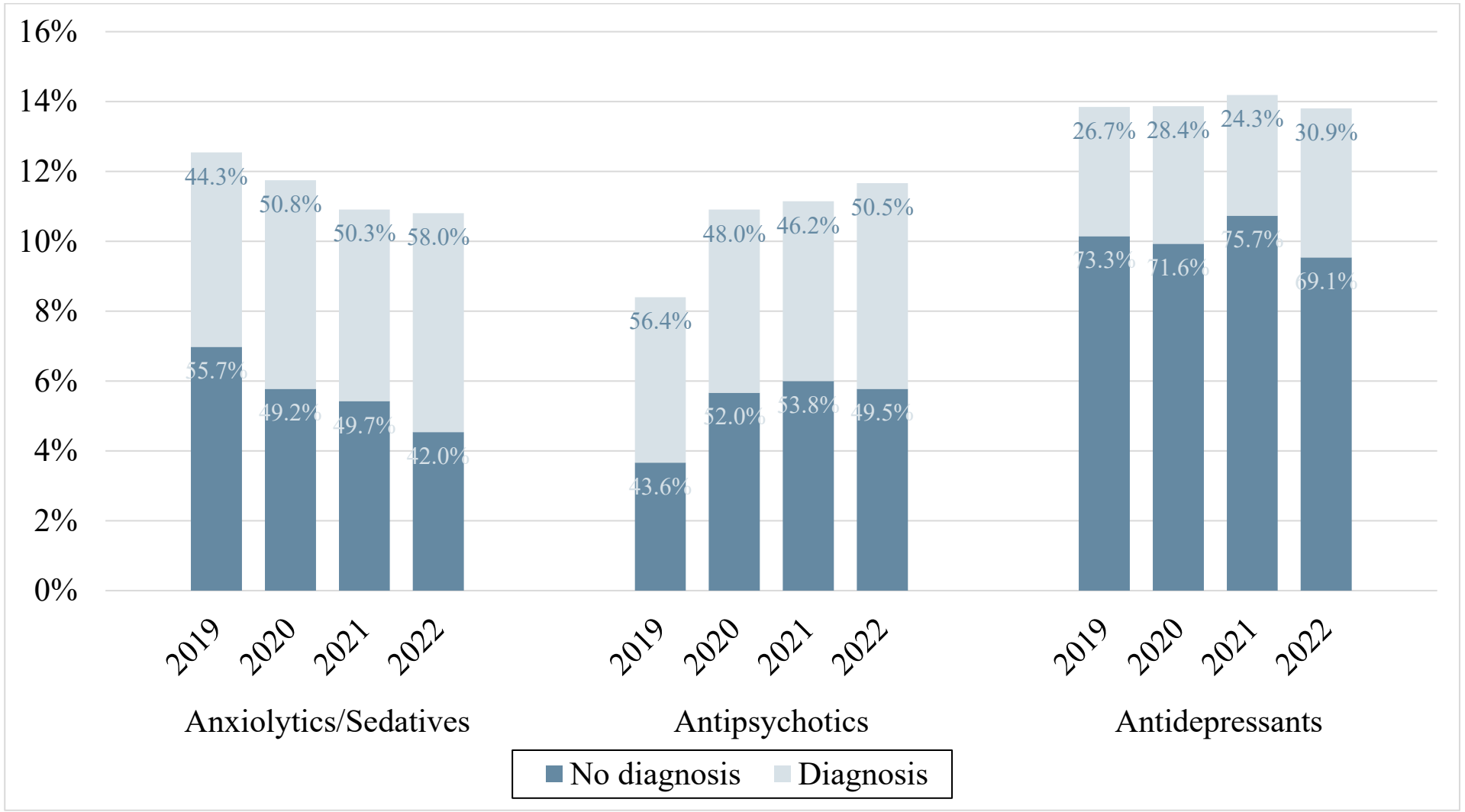


Figure S6: Proportion of sedative medication prescriptions with and without corresponding diagnoses, by study year.