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Uncovering antidepressant prescription patterns: a three-year analysis of outpatient trends

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Abstract

Background Antidepressants (ADs) are prescribed for various conditions, including neurological and rheumatoid diseases. This study aims to analyze ADs prescribing trends in Iranian outpatients over three years, with a focus on age, sex, and ADs class.

Methods A retrospective cohort study was conducted using prescription data from the Iranian Health Insurance Organization (IHIO) between March 2021 and March 2024. The dataset included 8,924,431 prescriptions from 3,524,273 patients who received at least one ADs. ADs were classified into four groups: tricyclic antidepressants (TCAs), selective serotonin reuptake inhibitors (SSRIs), serotonin and norepinephrine reuptake inhibitors (SNRIs), and atypical ADs. The data were processed via the cross-industry standard process for data mining and analyzed using a multivariate logistic regression model.

Results SSRIs were the most commonly prescribed class, accounting for 63.71% of prescriptions, with sertraline being the most common drug (24.65%). Females accounted for 66.11% of the patient population. ADs prescriptions increased with age, and females were more likely to receive TCAs and SNRIs than males, who had higher rates of atypical ADs use.

Conclusions This study revealed a notable increase in ADs prescriptions in Iran, particularly among women and older individuals. Continued monitoring of ADs prescription is crucial for optimizing outcomes, especially for vulnerable groups such as elderly individuals.

Keywords Mental health, Antidepressants, Prescription pattern, Retrospective cohort

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Introduction

Mental illnesses are recognized as a significant contributor to the worldwide disease burden and a primary factor in global disability [1]. According to the World Health Organization, over 450 million people worldwide are affected by mental health issues, with approximately 80% of those individuals residing in low- and middle-income countries (LMICs) [2]. Depressive and anxiety disorders are ranked as the 13th and 24th leading causes of disability-adjusted life years, respectively [3].

Antidepressants (ADs) are primarily prescribed for depressive and anxiety disorders, which frequently co-occur and account for approximately 75% of all ADs prescriptions [4]. They are also used to alleviate symptoms such as anhedonia and to reduce the risk of relapse [5] and treat other conditions, including neurological and rheumatoid diseases, as well as for various off-label purposes [6]. Additionally, ADs are recommended for both approved and unapproved uses, such as insomnia, pain, eating disorders, smoking cessation, migraines, and attention-deficit/hyperactivity disorder [4].

Depression (38.4%) and sleep issues (31.9%) are the primary factors associated with ADs use in LMICs [7]. From 2014 to 2019, ADs usage increased by an average of 43% across 64 countries, with the highest growth observed in middle-income countries (69%) compared with high-income (20%) and low-income (42%) nations [8].

The recommended duration of ADs use varies depending on the patient's condition. For example, individuals diagnosed with major depression are advised to continue ADs treatment for at least four to nine months after symptom remission, whereas those at a higher risk of recurrence may need to extend their use to two years or more [9]. Despite the need for extended treatment in some cases, the unjustified long-term use of ADs in 30-50% of patients raises concerns about potential side effects, including increased healthcare costs [10].

In the last 20 years, there has been a notable increase in the prescription of ADs medications [11]. The COVID-19 pandemic has had a significant impact on global mental health, with many people reporting a rise in disorders such as depression and anxiety. Psychological stressors such as social isolation, bereavement, economic instability, and fear of infection have been intensified during this period [12]. A recent study has reported marked increases in depressive and anxiety symptoms across the pandemic, which is likely one factor driving the increased need for ADS prescription [13].

This study is rooted in the population health paradigm, which investigated different determinants influencing the health outcomes of various populations. It is also informed by the pharmacoepidemiological approach, which examines patterns, and causes of medication use in humans to support optimal clinical and public health outcomes. As commonly prescribed pharmacologic agents, ADs illustrate larger patterns in healthcare more broadly, including accessibility, gender disparities, and age-adjusted prescribing patterns. This study aims to identify prescriptions in Iranian outpatients as a basis for statistical health modeling, to better detail patterns of prescribing and disparities that may reflect evidence-based mental health policy and better-targeted treatment. The results imply meaningful practice-wide consequences, including directing resource distribution, formulating more accurate clinical references, or lowering inappropriate ADs consumption, ultimately facilitating more effective and fair healthcare structures.

Methods

This retrospective cohort study analyzed all electronic prescriptions given to outpatients covered by the Iranian Health Insurance Organization (IHIO) between March 21, 2021, and March 20, 2024, who were prescribed at least one AD. The IHIO is one of Iran's largest health insurance providers, covering approximately 45 million people—equivalent to nearly half of the country's population. This ensures that the study population is representative of diverse regional characteristics across Iran. The IHIO's commitment to providing comprehensive health insurance coverage ensures that individuals from all backgrounds, whether in urban centers or rural communities, have access to necessary healthcare services.

The data were obtained from the Information Technology Department of the IHIO through legal procedures. The dataset includes detailed information on medication prescriptions. The dataset contains the following information: insured individuals' unique identification numbers, sex, and age; prescription details such as prescription identification numbers, drug names, generic codes, dosages, claim dates, and clinician information, including medical specialties. Herbal remedies, over-the-counter medications, and drugs administered in hospitals or nursing homes were not included in this database. Additionally, the dataset does not provide information on the treatment duration for each patient. Throughout the study, data confidentiality was strictly maintained. Both patient and physician identities were anonymized in the compiled dataset.

The data were processed using the Cross-Industry Standard Process for Data Mining (CRISP-DM) framework [14]. Patients without age or sex information on their prescriptions were excluded from the analysis. The study population was categorized into four age groups: 0–18, 19–39, 40–64, and 65 years and above. ADs were classified according to the World Health Organization's Anatomical Therapeutic Chemical (ATC) classification system (code N06A) and grouped into four categories based on the National Drug Code Directory: (1) tricyclic

Table 1 Demographic characteristics of the selected cohort

Year	Patients *N* (% among 3 years)	Sex (Female) *N* (%)	Age Median (IQR)	Prescriptions *N* (% among 3 years)	ADs *N* (% among 3 years)	Prescription per patient (mean ± SD)
2021–2022	1,252,058 (35.53)	849,747 (67.87)	53 (40, 63)	2,168,918 (24.30)	2,520,876 (24.03)	2.02 ± 1.96
2022–2023	1,616,689 (45.87)	1,092,052 (67.55)	52 (39, 63)	2,938,942 (32.93)	3,476,730 (33.06)	2.15 ± 2.16
2023–2024	2,034,587 (57.73)	1,360,508 (66.87)	51 (38, 62)	3,816,571 (42.77)	4,513,783 (42.92)	2.22 ± 2.21

Table 2 Distribution of sex, age, and prescription patterns among patients

Age category (years)	Sex	Age Median (IQR)	Patients *N* (%)	Prescriptions *N* (%)	Prescription per patient (mean ± SD)
0–18	**Female**	15 (13, 17)	97,635 (55.96)	169,510 (55.47)	1.74 ± 1.73
	Male	13 (9, 16)	76,802 (44.04)	136,085 (44.53)	1.77 ± 1.82
19–39	**Female**	32 (26, 36)	598,651 (63.24)	1,241,168 (62.61)	2.07 ± 2.28
	Male	31 (25, 35)	348,005 (36.76)	741,337 (37.39)	2.13 ± 2.64
40–64	**Female**	52 (46, 57)	1,197,769 (69.75)	3,250,420 (70.15)	2.71 ± 3.08
	Male	53 (46, 58)	519,339 (30.25)	1,382,802 (29.85)	2.66 ± 3.53
65–100	**Female**	71 (68, 77)	436,085 (63.56)	1,326,837 (66.24)	3.04 ± 3.36
	Male	72 (68, 79)	249,987 (36.44)	676,283 (33.76)	2.70 ± 3.12
Total	**Female**	49 (37, 61)	2,330,140 (66.11)	5,987,925 (67.1)	3.04 ± 4.04
	Male	49 (33, 62)	1,194,133 (33.89)	2,936,506 (32.9)	2.88 ± 4.27

antidepressants (TCAs); (2) selective serotonin reuptake inhibitors (SSRIs); (3) serotonin and norepinephrine reuptake inhibitors (SNRIs); and (4) nonclassified medications (atypicals) [15].

Data processing and statistical analysis

The analysis was conducted using Python software version 3.12.2, which was developed by the Python Software Foundation. Descriptive statistics were used to summarize the demographic and clinical features of the group, including the distribution of patients according to sex, age, and medication use over the three-year period. The median age of the patients was reported annually with the interquartile range (IQR), and the proportions of male and female patients were calculated. Mean and standard deviation (SD) values were used to describe the average number of prescriptions per patient and the number of ADs prescribed per prescription. Age-stratified analyses were conducted to evaluate prescription trends across different age categories (0–18, 19–39, 40–64, and 65–100 years). The frequency of prescriptions and average number of ADs per prescription were analyzed within each age group, stratified by sex. A logistic regression analysis was conducted to examine the associations between sex, age group, and the likelihood of prescribing various classes of ADs. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to quantify these associations, with males and the 0–18 age group used as reference categories. Statistical significance was determined with p values reported for all tests, with a threshold of $p < 0.05$.

Results

In total, 8,924,504 prescriptions with at least one prescribed ADs were included in the current study. Among these, 73 prescriptions were excluded because of unclear patient sex and age information. Thus, the final analysis included 8,924,431 prescriptions from 3,524,273 patients. The median age of the patients was 49 years (IQR of 36 to 61 years), and 66.11% were female. The number of female patients was approximately twice that of male patients, and this difference remained consistent over the three years. On average, each patient received 2.53 ± 3.0 prescriptions, including 2.98 ± 4.12 ADs. Approximately 83.85% of the prescriptions contained a single ADs, whereas dual ADs prescriptions accounted for 14.62%. The combination of sertraline and nortriptyline was frequently prescribed. Table 1 presents the demographic and clinical characteristics of the entire cohort, categorized by year.

As shown in Table 1, the average number of prescriptions per patient demonstrated an upward trend over the three years, increasing from 2.02 ± 1.96 to 2.22 ± 2.21. Similarly, as indicated in Table 2, the average number of ADs prescribed per age category also increased with age, from 1.95 ± 2.30 for patients aged 0–18 years to 2.52 ± 3.46 for those aged 19–39 years, 3.21 ± 4.50 for patients aged 40–64 years, and 3.31 ± 4.21 for individuals aged 65–100 years. This trend of increasing prescriptions with advancing age was observed for both sexes.

Findings in Table 2 show that the number of prescriptions and patients was greater among females than males in all age groups. An analysis of the age distribution

Table 3 Prescribed ADs and their attributed classes

Drug class	Prescription *N* (%)	ATC code	Drug name	Drug *N* (% among attributed class)
SSRIs	5,685,889 (63.71)	N06AB06	sertraline	2,208,161 (37.91)
		N06AB03	fluoxetine	1,163,417 (19.97)
		N06AB10	escitalopram	1,017,500 (17.47)
		N06AB04	citalopram	948,700 (16.29)
		N06AB08	fluvoxamine	379,634 (6.52)
		N06AB05	paroxetine	107,327 (1.84)
TCAs	3,600,836 (40.35)	N06AA10	nortriptyline	1,811,043 (49.37)
		N06AA09	amitriptyline	544,333 (14.84)
		N06AA02	imipramine	412,821 (11.25)
		N06AA04	clomipramine	265,476 (7.24)
		N06AA12	doxepin	249,866 (6.81)
		N06AX05	trazodone	201,351 (5.49)
		N06AA06	trimipramine	111,928 (3.05)
		N06AA21	maprotiline	63,230 (1.72)
		N06AA01	desipramine	8317 (0.23)
SNRIs	641,392 (7.19)	N06AX21	duloxetine	370,343 (56.24)
		N06AX16	venlafaxine	288,168 (43.76)
Atypicals	354,155 (3.97)	N06AX12	bupropion	249,650 (68.25)
		N06AX11	mirtazapine	106,972 (29.25)
		N06AX22	agomelatine	8675 (2.37)
		N06AF04	tranylcypromine	381 (0.10)
		N06AF01	isocarboxazid	86 (0.02)
		N06AG02	moclobemide	10 (0.00)

SSRIs: Selective serotonin reuptake inhibitors; TCAs: tricyclic antidepressants; SNRIs: serotonin and norepinephrine reuptake inhibitors; Atypicals: nonclassified medications

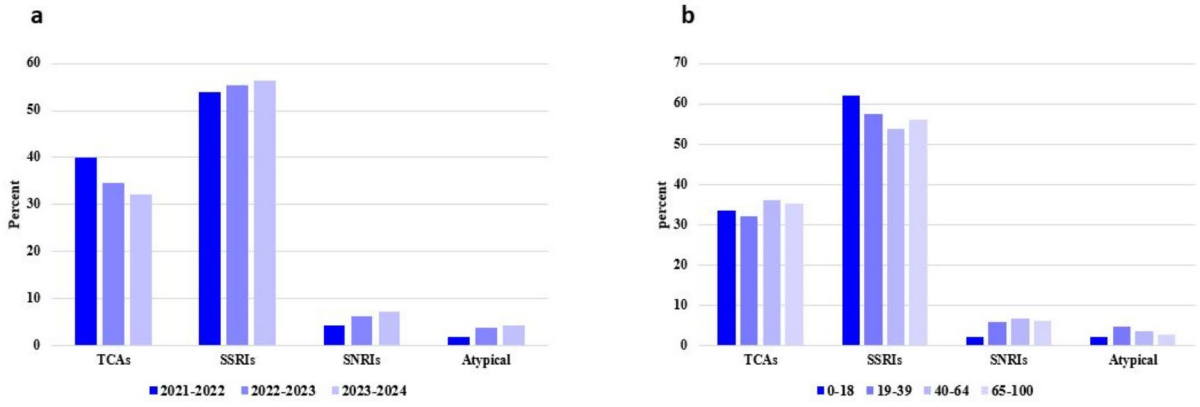

Fig. 1 Percentages of various ADs classes over the three years (**a**) and various age groups (**b**)

revealed that the majority of patients, 48.72%, were aged between 40 and 64 years. There were 174,437 patients (4.95%) in the 0–18 year age group, 946,712 patients (26.86%) in the 19–39 year age group, and 686,072 patients (19.47%) aged 65 years or older.

Throughout the three-year study period, the most frequent ADs to be prescribed were SSRIs (63.71%). Sertraline was the most commonly prescribed drug (24.65% of the total drugs claimed), followed by nortriptyline (20.26%) and fluoxetine (12.72%). Table 3 presents information on the frequency and percentage of prescriptions for each class as well as ADs categorized according to pharmaceutical classes and ATC codes.

Figure 1 illustrates the distribution of ADs classes, showing the contribution of each class to the total prescriptions across different years and age groups. Throughout the three years, SSRIs consistently dominated as the most frequently prescribed ADs class. In contrast, TCAs experienced a steady decline in usage. Conversely, prescriptions for SNRIs and atypical ADs

Table 4 Associations between sex and ad use classes

Predictor	Dependent variable	OR	95% CI	*p*-value
Sex (males as reference)	SSRIs	0.98	0.97–0.99	< 0.001
	TCAs	1.17	1.16–1.18	
	SNRIs	1.18	1.16–1.20	
	Atypicals	0.74	0.72–0.76	

SSRIs: Selective serotonin reuptake inhibitors; TCAs: tricyclic antidepressants; SNRIs: serotonin and norepinephrine reuptake inhibitors; Atypicals: nonclassified medications

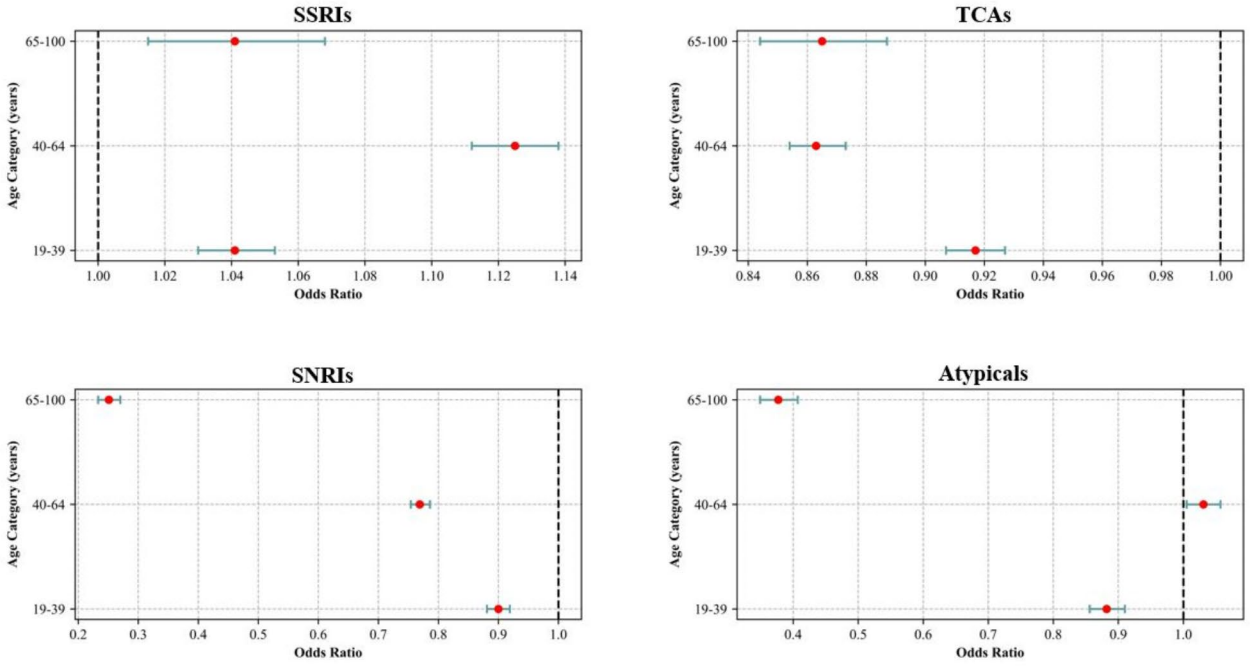

Fig. 2 Odds ratios for the use of different classes of ADs across age groups

exhibited a continuous upward trend. The data emphasize a strong prevalence for SSRIs, followed by TCAs, across all age groups, while the prescription of SNRIs and atypical ADs remains limited with advancing age.

SSRIs: Selective serotonin reuptake inhibitors; TCAs: tricyclic antidepressants; SNRIs: serotonin and norepinephrine reuptake inhibitors; Others: nonclassified medications.

Logistic regression analysis indicated that patient sex was associated with different classes of ADs (Table 4). The results demonstrated that females were slightly less likely to prescribe SSRIs (OR: 0.98) but were more likely to prescribe TCAs (OR: 1.17) and SNRIs (OR: 1.18). However, they had a reduced likelihood of being prescribed atypical ADs (OR: 0.74).

The findings suggest that, compared with the reference age group (0–18 years), the use of SSRIs is generally more common in all age groups above 18 years, with the highest likelihood in the 40–64 years group (OR: 1.12). Conversely, the likelihood of TCAs and SNRIs use decreases with increasing age, particularly among older age groups. The use of other ADs was somewhat comparable to that of the reference group for those aged 40–64 years but significantly lower for other age groups, especially the elderly (65–100 years) (Fig. 2).

SSRIs: Selective serotonin reuptake inhibitors; TCAs: tricyclic antidepressants; SNRIs: serotonin and norepinephrine reuptake inhibitors; Atypicals: nonclassified medications.

Discussion

The study revealed a significant increase in the number of patients and prescriptions involving ADs over time, with a slight increase in the average number of prescriptions per patient, indicating more frequent ADs use. SSRIs, particularly sertraline, were the most commonly prescribed ADs. Prescription rates were notably higher among females, with an increased frequency observed across all age groups. Logistic regression analysis revealed significant sex-based differences: females demonstrated a higher likelihood of being prescribed TCAs and SNRIs compared to males, while they were less likely

to receive atypical ADs. The study also revealed that the number of prescriptions of SSRIs tends to increase with age, whereas the number of prescriptions for other ADs classes decreases, particularly among elderly individuals (65–100 years).

This study revealed an increase of approximately 76% in prescriptions for ADs and a 79% increase in the number of ADs over three years. These trends are consistent with other studies highlighting the increasing prescription of ADs over the past decade in LMICs [16, 17] and other countries [3]. Mirghaed et al. [18] reported that approximately 31% of the population in Iran is affected by mental health disorders. The increasing trend in ADs use may be attributed to the rising stress induced by changes in social and environmental conditions, economic instability, and an increasing prevalence of physical health problems such as chronic pain [19, 20]. Economic sanctions have profound effects on the mental health of the Iranian population, contributing significantly to increased levels of anxiety and depression. These sanctions lead to a decline in the overall economic situation, which directly impacts the daily lives of individuals and families [21]. Additionally, factors such as increased awareness and diagnosis of mental health disorders, a reduction in stigma surrounding mental illness, and improved access to mental health services likely contributed to this increasing trend [22]. Furthermore, the rapid expansion of telehealth services during the COVID-19 pandemic, which reduced barriers to accessing mental health care, may have contributed to the increase in ADs prescriptions by enabling more individuals to seek timely treatment [23].

The increase in prescriptions per patient observed in the final year suggests that long-term ADs therapy or chronic treatment might be contributing factors, as reported in other studies such as Lunghi et al. [24], where 29.8% of participants were prescribed ADs for long-term use, and 19.9% received them for chronic treatment. However, this aspect was not directly investigated in our study, and further research is needed to explore this possibility. Additionally, this trend may also indicate an increase in the number of patients requiring multiple medication adjustments due to treatment-resistant depression [25].

In our study, SSRIs were the most commonly prescribed type of ADs, with a steady increase annually. Sertraline was the medication most frequently prescribed in this classification. This finding is in line with worldwide patterns and is in agreement with research from other nations where SSRIs have been established as the primary treatment for depression and anxiety because of their better safety and tolerance than other ADs [11, 26, 27]. In contrast to other ADs, which can cause serious side effects by affecting various neurotransmitter systems, SSRIs specifically focus on serotonin reuptake, leading to a lower chance of dangerous adverse reactions [28]. Hoehn-Saric et al. [29] reported that sertraline is especially helpful for individuals who have both depression and obsessive-compulsive disorder. Cipriani et al.'s 2010 meta-analysis [30] of 59 studies revealed that sertraline is more effective than fluoxetine and is better tolerated than mirtazapine, paroxetine, and amitriptyline for treating acute-phase depression. Additionally, Moscovitch et al. [31] demonstrated the effectiveness of sertraline in managing seasonal depression. This study, along with findings from other countries, indicates a notable decline in prescriptions for TCAs in recent years [32]. The reduction in TCA prescriptions may be attributed to updated guidelines for depression treatment. While TCAs were once the standard treatment, concerns about their adverse side effects, including cardiotoxicity effects, have contributed to their declining use [33]. Additionally, the increasing prevalence of depression worldwide has driven the development of newer ADs with better tolerability and broader therapeutic applications [34]. Therefore, the high prescription rates of SSRIs and SNRIs, along with the decreased prescription rates of TCAs over three years in this Iranian cohort, suggest a broader shift in prescribing patterns. This trend likely reflects a preference for medications with improved tolerability and safety profiles. Such shifts are crucial for tailoring treatments to individual needs and enhancing long-term adherence.

The sex difference observed in this study, with females displaying higher rates of ADs use than males do, is consistent with findings from other studies [35, 36]. Women are more likely to seek help for mental health problems and are more frequently diagnosed with mood and anxiety disorders [37]. A combination of biological and psychological factors can account for the increased occurrence of ADs in women [38]. Physiologically, changes in sex hormone levels during important life periods, such as puberty, pregnancy, and menopause, affect the control of emotions, leading to a greater likelihood of experiencing depression [39]. Furthermore, changes in neuroendocrine responses in females increase their vulnerability to stress and depressive disorders [38]. Psychologically, females exhibit greater cognitive vulnerability, often characterized by increased hopelessness and lower self-esteem, both of which are strongly linked to depression [40].

The increase in ADs use among the elderly (65 years old or older) observed in this study aligns with findings from earlier research [22, 41]. Studies have confirmed that ADs use increases with age, as mental health issues such as depression become more common due to factors such as isolation, bereavement, and cognitive decline [42]. As older adults face physical and mental health challenges, the demand for healthcare interventions is increasing. Nevertheless, healthcare professionals must

be vigilant when prescribing ADs to these demographics, carefully considering the potential benefits and risks. These risks involve adverse outcomes due to polypharmacy, drug interactions, and the use of medications that may be deemed inappropriate for this age group [43].

Another significant finding in our study was the age-based trend in ADs types. SSRIs were the most commonly prescribed ADs across all age groups, particularly among patients aged 0–18 years. This aligns with the findings of several other studies, in which SSRIs remain the preferred choice for pediatric patients with anxiety and depressive disorders because of their efficacy in reducing symptoms [44]. The decreased prescription of SNRIs and atypical ADs in older adults may reflect clinicians' efforts to minimize the risk of adverse effects in this population [45]. Interestingly, the use of TCAs was more prevalent among middle-aged and older adults in our study. This increase likely reflects their dual efficacy in managing both depression and chronic pain, which are common comorbidities in this population [46].

In the logistic regression analysis, we found that female patients were more likely to be prescribed ADs than male patients were. SSRIs are often the first-line treatment for depressive and anxiety disorders in both sexes. This finding is consistent with other studies, which also show that SSRIs are the most commonly prescribed class of ADs for both sexes because of their relatively mild side effects and strong safety profile [26]. The increased likelihood of females being prescribed TCAs or SNRIs is consistent with findings from other studies, which indicate that these medications are more frequently prescribed to women [47]. This pattern may be explained by the greater prevalence of chronic pain conditions, such as fibromyalgia and migraine, in females, where these drugs are often used as part of pain management [48]. These findings highlight the ongoing trend of avoiding older ADs, such as TCAs, when their risks exceed their therapeutic benefits. The higher prescription rate of atypical ADs among males than females may be explained by sex differences in the clinical presentation of depression. Females are more likely to exhibit comorbid anxiety symptoms, which often leads healthcare providers to favor SSRIs as first-line treatment in this population.

Another finding indicates distinct patterns in ADs prescription trends across age groups. SSRIs are more likely to be prescribed in adults and older adults compared to children, with the highest likelihood of SSRI prescriptions observed in middle-aged individuals compared to other age groups. This trend aligns with the literature suggesting that SSRIs are generally better tolerated in adults and older adults than other ADs are, which is especially important given the heightened sensitivity of this population to cardiovascular and central nervous system side effects [49]. On the other hand, the observed decrease in the odds of prescribing other ADs classes as age advances aligns with existing research that highlights the cautious use of these classes in this population due to their strong side effects, which can increase toxicity and adverse outcomes in the elderly [34]. The age-related patterns observed in this study are in line with prescription practices that prioritize minimizing risks in older adults while effectively treating depression. These findings support guidelines that advise caution when prescribing ADs to older individuals because they are included in the Beers criteria as potentially inappropriate medications for the elderly [50].

Although SSRIs are commonly prescribed for their safety and effectiveness, especially among children and older adults, a careful prescribing method has advantages and disadvantages. This approach focuses on reducing side effects and guaranteeing safety, but it might postpone the utilization of other antidepressant categories that could prove more beneficial for specific patients. Progress in precision medicine, including pharmacogenomic testing and personalized evaluations, may enhance treatment choices and endorse using alternatives as primary therapies when suitable clinically. Upcoming studies should aim to incorporate these innovations into clinical practice to ensure a balance between safety and personalized, evidence-informed treatment.

Strengths and Limitations.

This study is one of the first to offer a comprehensive analysis of ADs prescriptions in Iran, providing valuable insights that could inform future healthcare policies and clinical decision-making. The large sample size and extensive dataset strengthened the findings, emphasizing the need to tailor treatment strategies on the basis of factors such as sex and age.

However, interpreting these results requires caution. A key limitation of our study is that patient diagnoses are not required in electronic prescriptions in the IHIO, which complicates the identification of specific reasons for ADs prescriptions. For example, amitriptyline can be used for neuropathic pain, and duloxetine can be prescribed for urinary incontinence, in addition to depression and anxiety. Interestingly, the increase in ADs prescriptions may not reflect increased treatment needs, as data from 1990 to 2010 indicate a significant increase in ADs use despite stable rates of depression and anxiety disorders [27]. Furthermore, the sampled period (2021–2024) was selected to investigate the trends in the recent time period, particularly post–COVID-19 health care changes, but data before was not available in a matching format for the IHIO. Though this restricts comparisons with pre-pandemic trends, future research should incorporate data from before 2021 to contextualize longer-term trends.

Recommendations for policymakers and regulations

Based on the findings of this study, some suggestions can be put forward for the policymakers and consideration which pave the way for ADs use in Iran. Firstly, programs should be initiated to ensure the rational use of ADs ensuring up-to-date clinical guidelines that incorporate evidence-based prescribing, particularly in at-risk populations, i.e., older age groups. Lawmakers should also consider expanding mental health training for healthcare providers to ensure that they are prescribing appropriately and managing treatment resistance. Furthermore, stricter regulations would need to be put in place to oversee the long-term use of ADs to lower unjustified long-term therapy to avert potential adverse effects, as well as reduce the financial burden on the healthcare system. Policymakers must also ensure improved access to psychotherapy and other nonpharmacological treatments as viable alternatives to medication, particularly for patients with mild to moderate depression and anxiety disorders. Finally, electronic prescription systems that integrate diagnostic codes could help; they could enhance transparency in prescribing trends and facilitate precise analysis to inform future policy changes [51].

Conclusion

The study revealed a notable increase in the number of ADs prescriptions, predominantly SSRIs, in Iran, especially among women and older individuals. These prescription patterns align with global trends, highlighting the importance of personalized treatment strategies. The shift from TCAs to SSRIs reflects the updated clinical guidelines prioritizing safety and tolerability. Continued monitoring of ADs prescriptions is crucial for optimizing outcomes, particularly for vulnerable groups such as elderly individuals. However, the reasons behind this trend—whether improved depression detection, increased prevalence, or both—require further investigation to better understand these dynamics.

Abbreviations

ADs	Antidepressants
ATC	Anatomical Therapeutic Chemical
CI	Confidence interval
CRISP-DM	Cross-Industry Standard Process for Data Mining
IHIO	Iranian Health Insurance Organization
IQR	Interquartile range
LMIC	Low- and middle-income countries
OR	Odds ratio
SD	Standard deviation
SNRIs	Serotonin and norepinephrine reuptake inhibitors
SSRIs	Selective serotonin reuptake inhibitors
TCAs	Tricyclic antidepressants

Author contributions

L.GH. led the conceptualization, writing, and editing of the manuscript, and administration, as well as contributing to methodology design, validation, and visualization for the manuscript. H.K. led work on methodology and formal analysis and contributed to drafting sections of the manuscript, review and editing, and visualization. N.A. led the conceptualization, writing, editing of the manuscript, and administration. M.E. led the conceptualization, writing, editing of the manuscript, and administration, as well as contributing to methodology design. R.M. led work on methodology and formal analysis and was responsible for acquisition of data, visualization, and manuscript editing. AS.R. worked on methodology and formal analysis, R.D. led the writing, editing of the manuscript, and administration, as well as contributing to methodology design. All authors read and approved the final manuscript.

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Data availability

Due to the nature of the data used in this study, we regret that we are unable to share the dataset. The data belong to the IHIO and contain sensitive and confidential information, including patient and physician data. Sharing such information would violate ethical standards and the privacy regulations in place to protect personal health data. Access to the dataset was granted under strict conditions, and its use is restricted to ensure compliance with these confidentiality obligations.

Declarations

Human ethics and consent to participate

This study adhered to the principles established in the Declaration of Helsinki and national and international ethical regulations. The research team processed and analyzed the data on a secure platform. Participant anonymity was rigorously maintained, with no personal identifying details shared in any public materials. The Research Ethics Committees of the National Institute for Health Research-Tehran University of Medical Sciences approved this study (approval ID: IR.TUMS.NIHR.REC.1402.023). This study utilized anonymized data from electronic prescription records and did not involve direct patient interaction. All identifying information, including patient names, physician names, and identification numbers, was securely anonymized to maintain privacy and confidentiality. Per national regulations and ethical guidelines, informed consent was deemed unnecessary for this type of secondary data analysis.

Consent to Publish

Not applicable.

Competing interests

The authors declare no competing interests.

Clinical trial number

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