# Exploring Patterns of Methylphenidate (Ritalin) Consumption: An Epidemiological Study in Northwestern Iran (Urmia City, 2022)

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# Abstract

**Background** The prevalence of methamphetamine consumption among youth in Iran is high, but there is a lack of information in provincial level. Therefore, this study aimed to investigate the epidemiology of methamphetamine use in city of Urmia in the Northwest of Iran.

**Method** Data of study was collected from patients referred to the Food and Drug Administration of Urmia University of Medical Sciences between December 2021 and May 2022. We calculate the prevalence of legal Ritalin use in the city and describe the characteristics of the patients. The ordinal logistic regression model was employed to explore the moderating effects of studied factors on drug consumption levels. Analysis was done in STATA 15.

**Results** A total of 473 individuals sought Ritalin, with 314 (66.3%) being male. The prevalence of legal Ritalin use in Urmia during the first six months of 2022 was 85.3 per 100,000 people. The majority of individuals were under 20 years old 305 (64.4%). There was a significant difference in the age distribution between male and female (P< 0.001). The most common reason for referral was ADHD & ADD, with 354 individuals (74.8%), and the majority of visitors had an elementary and middle school education 226 (47.7%). University students mainly 34 (55.7) use Ritalin to focus on studding.

**Conclusion** Students are in high-risk groups for Ritalin misuse. Considering the cultural and social conditions of Iran, the actual prevalence of drug consumption are likely to be much higher than reported, to accurately estimate the volume of this problem, more extensive studies using more accurate methods are needed.


# Background

The youth is the main population at risk for substance abuse in each country [1]. Between 162 and 324 million individuals globally have used illicit substances like heroin, cannabis, cocaine, and amphetamine-type stimulants within the past year. Notably, methamphetamine (METH) is a highly addictive psycho-stimulant and poses a significant health concern in Iran [2]. It is a global epidemic among young people and can have negative effects on their education and professional lives [1].

The prevalence of substance abuse is estimated to be between 2% and 3% [3, 4], this prevalence is not a fixed number and changes each year, requiring annual studies in this field. The prevalence of METH dependence is less than 1% in the general population of Iran. Various reports have revealed that the prevalence of METH use in Iran has increased among methadone maintenance treatment (MMT) patients [5].

The reported rate of drug-related deaths in Iran is approximately 38.2 per million population [6]. The most significant contributing factors are anxiety, stress, occupational challenges, academic pressure, and sleep disorders [7]. Amphetamine-type stimulants (ATS) are a major health concern after cannabis worldwide [8]. The use of methylphenidate (MPH) is globally increasing [9] while MPH is considered safe

when taken as prescribed, it has the potential for abuse due to its focus-enhancing, appetite-reducing, and euphoric effects [10, 11]. MPH is commonly preferred and well-tolerated in the treatment of children and adolescents. However, certain side effects may occur during treatment, including nausea, lack of appetite, weight loss, and sleep disturbances [12].

In addition to these common side effects, MPH has also been reported to cause rare side effects such as skin eruptions [13, 14], inappropriate sexual behavior [15], obsessive-compulsive symptoms[16],hallucinations, pain[17], full muscle cramps[18] and excessive and frequent menstrual bleeding. Gynecomastia is a rare side effect during MPH therapy [19].

Students using methylphenidate can experience numerous side effects, such as hallucinations, anxiety, dry mouth, and visual disturbances [20]. Withdrawal symptoms can include fatigue, disturbed sleeping patterns, and depression, while the use of high doses can result in cardiovascular failure or lethal seizures [21].

In 2009, after reviewing the available research evidence, the Committee for Medicinal Products for Human Use (CHMP) concluded that the ratio of benefit-to-risk for MPH when used for authorized indications, such as Attention deficit hyperactivity disorder (ADHD), was favorable (European Medicines Agency, 2007). However, they also noted that more data were needed on long-term effects in children and young adults, including neurological and psychiatric effects. In particular, the CHMP noted a range of psychiatric adverse events, including aggression, psychosis, mania, irritability, and suicidality, and suggested that methylphenidate may play a causative role in the development of serious psychiatric disorders [22].

Students are taking methylphenidate for academic purposes, calling it a 'smart drug' or 'study drug’. A previous systematic review of 21 studies showed that 5%-9% of grade school and high school-age children, as well as 5%-35% of college-age students, misused stimulants such as methylphenidate and amphetamines. In addition, children and adolescents take methylphenidate to stay up for parties and experience euphoria [23].

Due to the potential for misuse of methylphenidate, numerous countries classify and regulate the drug legally [9]. While it is true that certain college students may require psychiatric medications, it is important to acknowledge that some individuals may engage in the unauthorized use of these medications. It has been suggested that certain individuals perceive psychiatric medications as performance-enhancing substances that could potentially address severe psychiatric symptoms and enhance productivity, efficiency, and relaxation. According to the national survey reports on drug use and health in 2006, almost one-third of individuals aged 18 to 25 have engaged in the illicit use of prescription drugs [24]. Moreover, it is worth noting that some individuals who do not suffer from ADHD may illicitly utilize methylphenidate for weight control, alleviating sleeplessness, boosting energy levels, enhancing concentration, and improving educational, occupational, or athletic performance [10, 25].

This study is the first to explore the use of ritalin in Urmia city, a location in northwestern Iran. The goal is to increase knowledge about the prevalence of Ritalin use in this region, which has not been studied before.

# Methods

The present study employed a cross-sectional design to gather data from patients between December 2021 and May 2022 who visited the Food and Drug Administration of Urmia University of Medical Sciences.

The study variables included age, gender, educational level, reason for drug use, and daily consumption of Ritalin, which were obtained from official documents. The frequency of drug use was expressed as a percentage, and the statistical significance of its relationship with other variables was assessed using the Chi-square (Fisher's exact) tests. An ordinal logistic regression model was employed to investigate the moderating effects of age and gender on drug consumption levels. A significance level of less than 0.05 was considered statistically significant, and all analyses were conducted using the STATA version 15 statistical software.

# Results

During six months, 473 individuals were referred to the Food and Drug Administration of Urmia University of Medical Sciences to obtain Ritalin, of which 314 (66.3%) were male. The prevalence rate of legal ritalin use in Urmia in six months of 2022 was 85.3 per 100,000 people which the rate in men was more than double that women (Fig. 1).

Most of the individuals were under 20 years of age with 305 (64.4%) falling in this age group, while the lowest number of individuals was in the age group of 21–30 years, with 65 (13.7%). There was a significant difference in the age distribution of male and female visitors ($P < 0.001$), with 224 (71.3%) males and 81 (50.9%) females under 20 years of age. In the 21–30 age group, 35 (11.1%) males and 30 (18.9%) females were referred (Fig. 2).

The most common reason for referral was ADHD & ADD, with 354 individuals (74.8%) referred for this reason, followed by 61 individuals (12.9%) for concentration in studying. The least common reason was depression, with 45 individuals (9.5%). Although ADHD & ADD were the most common reasons for referral in both genders, but the referral for depression was more than twice as high in females than males, with 24 (15.1%) compared to 21 (6.7%) in males ($P = 0.003$).

Table 1
the distribution of age, education and monthly use of Ritalin by the courses

| Factor | | ADHD & ADD | Depression Control | To Focus On Studying | To Reduce The Stress | P.value |
|---|---|---|---|---|---|---|
| N | | 354 | 45 | 61 | 13 | |
| Age (%) | 0–20 Years | 282 ( 79.7) | 1 ( 2.2) | 22 ( 36.1) | 0 ( 0.0) | < 0.001 |
| | 21–30 Years | 29 ( 8.2) | 3 ( 6.7) | 30 ( 49.2) | 3 ( 23.1) | |
| | > 30 Years | 43 ( 12.1) | 41 ( 91.1) | 9 ( 14.8) | 10 ( 76.9) | |
| Education (%) | Illiterate | 47 ( 13.3) | 4 ( 8.9) | 0 ( 0.0) | 0 ( 0.0) | < 0.001 |
| | School Student | 223 ( 63.0) | 1 ( 2.2) | 2 ( 3.3) | 0 ( 0.0) | |
| | University Student | 15 ( 4.2) | 1 ( 2.2) | 34 ( 55.7) | 1 ( 7.7) | |
| | National Entrance Exam | 9 ( 2.5) | 0 ( 0.0) | 21 ( 34.4) | 0 ( 0.0) | |
| | Unknown | 60 ( 16.9) | 39 ( 86.7) | 4 ( 6.6) | 12 ( 92.3) | |
| Monthly Use (%) | 30 Tablets | 97 ( 27.4) | 13 ( 28.9) | 22 ( 36.1) | 5 ( 38.5) | 0.415 |
| | 31–60 Tablets | 131 ( 37.0) | 16 ( 35.6) | 15 ( 24.6) | 2 ( 15.4) | |
| | =>90 Tablets | 126 ( 35.6) | 16 ( 35.6) | 24 ( 39.3) | 6 ( 46.2) | |

The educational level of the visitors was mostly elementary and middle school, with 226 (47.7%) individuals. The number of illiterate individuals and university students was the same, with 51 (10.7%) individuals. The number of elementary and middle school students in males was 171 (54.5%), while in females, it was much lower, with 55 (34.6%). In contrast, the number of female university students was higher than males, with 21 (13.2%) compared to 30 (9.6%) ($P < 0.001$).

In terms of frequency of monthly Ritalin tablet consumption, a total of 137 individuals (28.9%) consumed one tablet daily, while 164 individuals (34.6%) consumed two tablets daily and the remaining 172 individuals consumed three or more tablets per day. This consumption distribution was similar between genders ($P = 0.06$).

Age and educational level were found to be important factors related to the reason for Ritalin consumption. Those who were referred for ADHD & ADD were mostly under 20 years of age, with 282 (79.7%) individuals falling in this age group. Of those who used Ritalin to control stress, 22 (36.1%) were under 20 years of age. On the other hand, most individuals who used Ritalin to control depression were over 30 years of age, with 41 (91.1%) individuals ($p < 0.001$).

Table 2
the distribution of education and monthly use of Ritalin by age groups

| **Age** | | | | | |
|---|---|---|---|---|---|
| Factor | | **0–20 Years** | **21–30 Years** | **> 30 Years** | **P. value** |
| N | | 305 | 65 | 103 | |
| Education (%) | **Illiterate** | 47 (15.4) | 0 ( 0.0) | 4 ( 3.9) | < 0.001 |
| | **School Student** | 225 (73.8) | 0 ( 0.0) | 1 ( 1.0) | |
| | **University Student** | 1 ( 0.3) | 42 (64.6) | 8 ( 7.8) | |
| | **National Entrance Exam** | 28 ( 9.2) | 2 ( 3.1) | 0 ( 0.0) | |
| | **Unknown** | 4 ( 1.3) | 21 (32.3) | 90 (87.4) | |
| Monthly Use (%) | **30 Tablets** | 84 (27.5) | 24 (36.9) | 29 (28.2) | 0.061 |
| | **31–60 Tablets** | 119 (39.0) | 17 (26.2) | 28 (27.2) | |
| | **=>90 Tablets** | 102 (33.4) | 24 (36.9) | 46 (44.7) | |

Table 3
Ordinal logistic regression for the effect of sex, and age on the monthly use of Ritalin

| **Monthly Consumption** | **Odds Ratio** | **SE** | **t-value** | **P-value** | **95% CI** | | **Sig** |
|---|---|---|---|---|---|---|---|
| **sex : base Female** | 1 | | | | | | |
| **Male** | 1.544 | 0.287 | 2.33 | 0.02 | 1.072 | 2.223 | ** |
| **0–20 years** | 1 | | | | | | |
| **21–30 years** | 0.971 | 0.254 | -0.11 | 0.912 | .582 | 1.622 | * |
| **>30 years** | 1.446 | 0.317 | 1.68 | 0.093 | .941 | 2.221 | |
| **cut1** | -0.545 | 0.179 | .b | .b | − .895 | − .194 | |
| **cut2** | 0.931 | 0.183 | .b | .b | .573 | 1.289 | |
| **Akaike crit. (AIC)** | **1037.307** | | **Bayesian crit. (BIC)** | **1058.102** | | | |
| ***** P < .01, ** P < .05, * P < .1** | | | | | | | |

The ordinal logistic regression model results indicated a rank order of influential factors on the monthly consumption level of Ritalin tablets. The gender and age of individuals were found to be significant factors in daily Ritalin consumption. After controlling for age, males were 1.5 times more likely than females to be in a higher consumption level. Furthermore, by controlling for gender, individuals over 30 years of age had a 1.4 times greater chance than those under 20 years of age to be in a higher consumption level. These findings suggest that gender and age should be taken into account in prescribing and monitoring Ritalin consumption (Table 3).

# Discussion

The findings of this research offer valuable insights into the previously unknown of Ritalin use in Urmia City, contributing significantly to the existing literature on substance abuse and public health in the region. Over six months (December 2021 -May 2022), the Food and Drug Administration at Urmia university of medical sciences received 473 referrals for Ritalin, with males accounting for the majority and most of them being under 20 years of age. Consumers aged 0–20 stated that ADHD was the main reason for their consumption. In the age group of 21–30 years, most of them were students (64%), and the main reason for consumption was focusing on studying (49.2%).

There were no search results found that specifically addressed the trend of the use of Ritalin prevalence in European and Asian countries. However, the study in Germany shows that there has been a notable increase in the use of ADHD medication over the 2009–2016 (28–41%) prescriptions issued by pediatric psychiatrists aged between 5 and 14 years [2]. Another study discusses the reasons behind the low prevalence of Ritalin use in France and notes that restrictive conditions of prescription in France are restricted to a hospital-only prescription for the initial treatment and yearly consultations [26].

Moreover, prevalence of any ADHD medication use were evaluated in two studies, previous study in 64 countries and regions from 2015 to 2019 shows Current ADHD prevalence estimates and rates of ADHD medication consumption in most middle-income countries are lower than the global epidemiological prevalence [27]. Previous study using adults and children between 2001 and 2015, Among adults aged 19 years or older, the prevalence of any ADHD medication use in 2010 varied between 0.003% and 1.48% (0.05% in Asia) [28]. Our finding similarly shows diagnosed Ritalin consumption had lower than reported global prevalence.

In another systematic review /meta-analysis (until July 31, 2019) in Iran the pooled lifetime and 12-month prevalence of ATS use was 5.4% (95% CI: 4.9%-6.0%) and 2.4% (95% CI: 1.9%-2.9%), respectively. The pooled lifetime prevalence of non-prescribed methylphenidate (Ritalin) use is 16.4% (95% CI: 11.6%-21.2%) in the Iranian general population [20].

According to the world health organization, by 2020, depression ranked as the second most prevalent cause of disease burden following ischemic heart disease [29]Among the elderly population in Iran, the prevalence of depression was found to be 53.7%, with a significantly higher prevalence in women compared to men (56.1% vs. 43.2%) [30]. It is noteworthy that depressive disorders and symptoms are

more frequently observed in women than in men [31]. In the present study, an additional rationale for the utilization of Ritalin was to manage depression, which is notably more prevalent in women over 30 years of age compared to men at a rate of more than double. Furthermore, the predominant usage of Ritalin to alleviate stress was observed among women, outnumbering men by more than threefold. These findings indicate a potential disparity in stress levels between men and women in our society. Regarding Ritalin consumption patterns, women constituted a larger proportion of low consumption (1 unit per day), whereas men were the primary consumers in the high consumption category (more than 3 units). It seems that restricting access to third-party consumers, especially students and academics, do not have much effect on access to this drug. This is because, in addition to pharmacies, which are the legal distributors of this drug, it is also sold in the open market at a much higher cost. The use of ATS is a major health concern after cannabis worldwide [20].

Ritalin is predominantly prescribed for the treatment of ADHD and narcolepsy. Current evidence shows the utilization of stimulants like modafinil or methylphenidate may enhance cognitive functions in cancer patients experiencing cognitive impairment due to chemotherapy [32]. Additionally, Methylphenidate has the potential to mitigate cognitive decline, specifically targeting functions closely associated with the preservation of executive functioning [33].

Nonetheless, there are documented instances of non-medical usage of Ritalin, particularly among students, aimed at enhancing academic performance. In the academic context, the primary motivations for the use of Ritalin encompass augmenting concentration, improving memory, and heightening alertness [34].

One research revealed that the non-medical use of methylphenidate among medical students is principally oriented towards enhancing academic performance [16]. The influence of living arrangements, particularly residing in independent accommodations, appears to be a significant factor in the non-medical use of methylphenidate. Furthermore, individuals in training and assistant positions exhibit a higher incidence of non-medical methylphenidate use compared to those in other educational strata. Importantly, the period preceding internship and assistantship examinations emerges as a critical phase for initial acquaintance and the commencement of non-medical methylphenidate utilization.

The participants in the current study provided data on their monthly frequency of Ritalin tablet consumption. Notably, 28.9% of the individuals reported using one tablet per day, while 34.6% reported consuming two tablets daily. A majority of the participants (65.3%) indicated a daily consumption of three or more tablets. Conversely, a separate study focusing on Iranian medical students found that the majority (54.3%) used the lowest dosage [35].

In the present study, we observed a higher proportion of male students attending elementary and middle school (54.5% vs. 34.6%), while a greater percentage of female students were found in university settings (13.2% vs. 9.6%). Although limited information is available in the search results regarding Ritalin consumption, a study conducted in Iran revealed a notable prevalence (11.2%) of nonmedical Ritalin use across different educational stages and marital statuses. Additionally, a separate study at Zahedan (in

South-eastern Iran) University of Medical Sciences documented that 13.9% of medical students had used Ritalin at least once, with the primary reason for consumption being the enhancement of academic performance. Furthermore, this research indicated a higher prevalence of non-medical Ritalin use among female students compared to their male counterparts [16].

A Systematic Review carried out in Iran revealed a substantial prevalence of Ritalin misuse among students, ranging from 5–43%. The high prevalence of Methylphenidate misuse is of concern due to its associated side effects, signifying a potential alarm for young individuals in Iran [36] Moreover, a study involving British medical students indicated that 18% of those who had utilized neuro-enhancing drugs had specifically used Ritalin to augment their academic performance [37].

In this study, gender and age were identified as significant factors influencing the degree of Ritalin consumption. When adjusting for age, it was found that males were 1.5 times more likely than females to consume higher quantities of Ritalin. Furthermore, individuals over the age of 30 exhibited a 1.4-fold increased likelihood of consuming higher amounts compared to those under 20, after adjusting for gender. Additionally, the findings indicated that ADHD diagnosis predominantly impacts boys over girls. A French retrospective cohort study utilizing a general health insurance scheme revealed increasing trends in ADHD diagnoses among children and adolescents, with a noticeable gender discrepancy wherein ADHD affects more boys than girls [38]. One study revealed a Ritalin consumption frequency of 17.3% among medical students, with no reported significant variations between male and female students. However, an Iranian systematic review indicated that the combined lifetime prevalence of non-prescribed methylphenidate (Ritalin) use was 18.7% among men and 4.6% among women [16]. These findings underscore the significance of taking into account male gender and individuals over 30 years of age when prescribing and overseeing Ritalin consumption within the general population.

Several studies have documented cases of oral methylphenidate misuse disorder (MPHUD) associated with significant mood disturbances during abstinence. Moreover, it has been observed that as the abstinence period extends, the symptoms of depression and anxiety tend to diminish. Time-dependent affective disturbances during abstinence have been reported among various substance abusers, encompassing individuals using methamphetamine, alcohol, nicotine, and heroin [10]. Considering the abstinence-related mood disturbances, it is imperative to consider targeted management of individuals experiencing MPHUD. [6] The development of psychosis has also been reported [39]. Disruption of mesolimbic dopamine transmission, neurotropic factor decreases, and altered opioid receptor signaling were implicated in the altered affective processing in the abstinence period, including other psychostimulant abusers (e.g., methamphetamine) [8–10]. Indeed, withdrawal from MPH exposure increases midbrain neural activity and alters the stress sensitivity of the brain [11]. Other clinical cases have reported depression, fatigue, loss of appetite, and even movement disorders (e.g., dystonia) in MPH abstinence [12, 13].

The findings revealed a positive association between negative emotion, social pressure and the daily dosage of Ritalin in the subjects studied [2]. Among the studied population, 10.7% were college students

and 47.7% were school students, with 55.7% of these students using Ritalin for studying purposes. It's important to note the high prevalence of Methylphenidate (Ritalin) misuse among students in Iran raises concerns, due to its associated side effects. There is a critical need to enhance awareness regarding the use of Methylphenidate to address this issue effectively in Iran [36] .

# Conclusion

In Iran, the prevalence of Ritalin abuse was reported to be negligible in general population, similar many other middle income countries. However, the prevalence of stimulant use disorders, including Ritalin, in Iran was found to be lower compared to other middle-income countries. Additionally, studies on university students have shown that Ritalin is the most common type of stimulant used among students, indicating a certain level of prevalence within this specific demographic group. In order to obtain a more precise estimation of the prevalence, it is curtail to conduct comprehensive survey among population. Valuable sampling methods for estimating the sizes of hidden populations provides a flexible and potentially more accurate means of estimating the prevalence of Ritalin use in populations, contributing to improved public health interventions and policy decisions.

# Abbreviations

ADD Attention Deficit Disorder

ATS Amphetamine-type stimulants

ADHD Attention Deficit Hyperactivity Disorder

CHMP Committee for Medicinal Products for Human Use

MMT Methadone Maintenance Treatment

METH Methamphetamine

MPH Methylphenidate

MPHUD Methylphenidate misuse disorder

# Declarations

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### Authors' contributions

Conception and design: Elham Moharamzade, Mohammad Heidari

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Final approval of manuscript: All authors

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**Availability of data and materials**

All data generated or analyzed during this study are included in this published article .The datasets used and/or analyzed during the study are available from the corresponding author on reasonable request.

**Ethics approval and Consent to Participate**

The study was approved by the Ethics Committee of Urmia University of Medical Sciences with the code: IR.UMSU.REC.1402.045. The data of patients receiving Ritalin prescriptions are recorded and compiled in the Treatment deputy of Urmia University of Medical Sciences, specifically in the Legal Distribution of Ritalin department. Access to this information is granted with the approval of the university's ethics committee, and the results are presented without disclosing the patients' identity details. Therefore, informed consent is not required in this case.

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# Figures

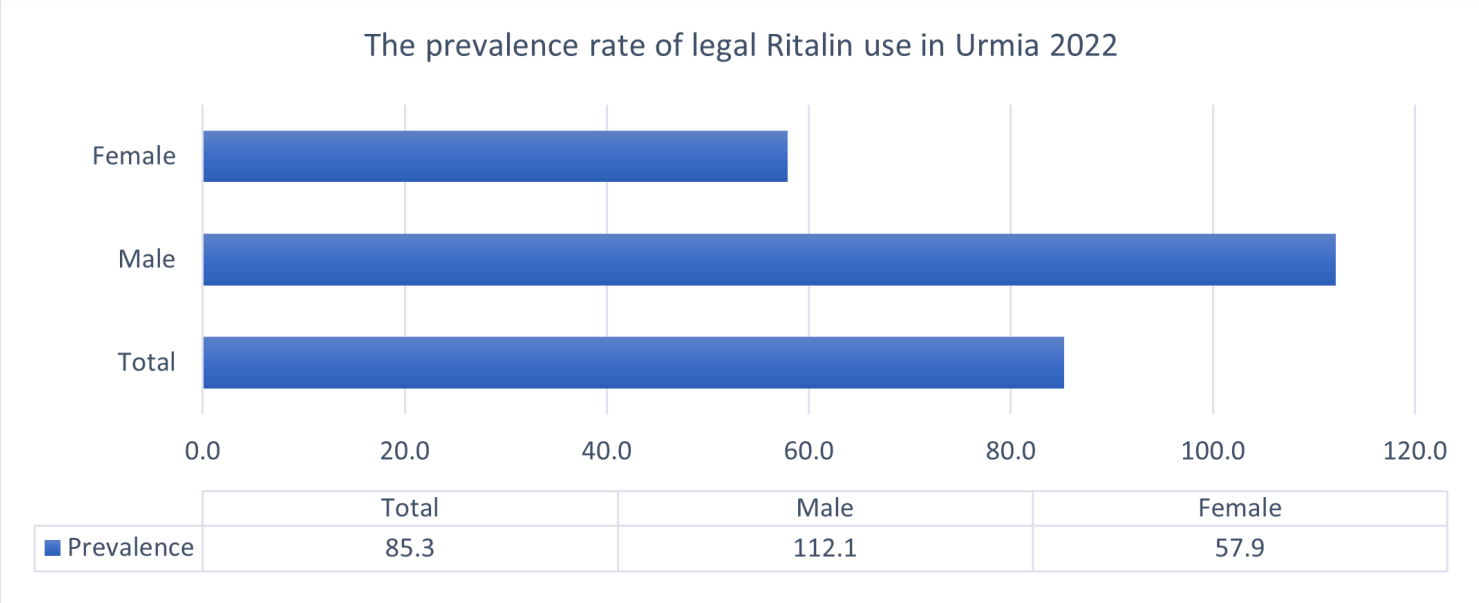


**Figure 1**

The prevalence rate of legal Ritalin use per 100,000 in Urmia 2022 foe male and female


## Figure 2

the age and sex distribution of the cases of Ritalin use in Urmia in 2022