Original Article

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Evaluation of Urine Drug Screening for Substance Use Based on Medical Laboratory Data from a Tertiary Hospital in Istanbul

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Abstract

Aim: Substance use is a significant public health concern, and early detection is essential for prevention and intervention. The study aimed to assess the prevalence and demographic patterns of substance use, including polysubstance use, based on five years of urine drug screening data.

Methods: This retrospective descriptive study analyzed urine drug screening results from 8,051 individuals tested between January 1, 2020, and June 31, 2024, at University of Health Sciences Türkiye, Basaksehir Cam and Sakura City Hospital. The panel included amphetamines, cannabis, opiates, cocaine, benzodiazepines, K2-3 synthetic cannabinoids, barbiturates, buprenorphine, and ethyl glucuronide. Statistical analyses used SPSS v26.0 ($p<0.05$).

Results: Among 6,006 valid tests, 25.2% were positive for at least one substance, most commonly benzodiazepines, amphetamines, and cannabis. Females had slightly higher positivity than males; however, this difference was without statistical significance. Benzodiazepine use was significantly higher in females [odds ratio (OR)=21.4; 95% confidence interval (CI): 16.55-27.75], while amphetamines were more common in males (OR=1.609; 95% CI: 1.22-2.11). Positivity in individuals under 18, was 27.1%, which was not statistically significant (p=0.560). Polysubstance use occurred in 15.8% of positive cases.

Conclusion: The findings reveal urgent, gender-specific risks in benzodiazepine and polysubstance use, underscoring the need for targeted prevention, improved outpatient care, updated clinical guidelines, and comprehensive monitoring systems.

Keywords: Amphetamines, benzodiazepines, public health, retrospective studies, substance-related disorders

Introduction

Substance abuse is a significant public health concern, affecting millions of individuals worldwide. According to the World Drug Report, global drug use increased by approximately 20% in 2022 compared to the previous decade (1). Similarly, the 2024 European Drug Report highlighted a rise in illicit drug use across all sectors of society, noting that nearly all psychoactive substances have the potential for misuse (2). Recent studies continue to confirm these trends, emphasizing the ongoing global challenge of substance abuse (3,4). According to the World Drug Report, global drug use increased by approximately 20% in 2022 compared to the previous decade (1). Similarly, the 2024 European Drug Report highlighted a rise in illicit drug use across all sectors of society; it noted that nearly all psychoactive substances have the potential for misuse. Recent studies continue to confirm these trends, emphasizing the ongoing global challenge of substance abuse. The misuse of psychoactive substances, including alcohol and illicit drugs, poses serious physical, psychological and social risks. Addressing substance abuse is thus vital not only for individual health but also for safeguarding public well-being. Early diagnosis and timely intervention are critical in mitigating the adverse effects

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of addiction, with substance screening recognised as an essential component of the treatment process (2).

We hypothesized that analyzing urine drug screening data from our laboratory would provide valuable insights into substance use prevalence, testing patterns, and the demographic characteristics of individuals undergoing screening. In Türkiye, the Ministry of Health's Medical Laboratories Regulation mandates that all licensed laboratories conducting substance analyses comply with established standards and report their findings accordingly. The standard screening panel includes amphetamines, benzodiazepines, cannabis, cocaine, and opiates, with confirmatory testing performed only after a positive screening result (5,6). Urine testing protocols developed by the Substance Abuse and Mental Health Services Administration (SAMHSA) have long been considered the gold standard in this field (7-9). Furthermore, in accordance with the Medical Laboratories Regulation (10) and the relevant circular (5), appropriate laboratory infrastructures, including designated specimen collection areas, have been established to support the detection of both emerging and commonly used narcotic and stimulant substances. Our laboratory conducts urine substance screening analyses in full compliance with these regulatory requirements.

This study aims to enhance awareness of substance use by analysing urine screening data collected in our laboratory. It investigates substance prevalence, patterns of test requests, and the influence of demographic factors—particularly age and gender—on positivity rates and polysubstance use. This, in turn, contributes to clinical practice by supporting early detection strategies, informing preventive health policies, and providing evidence-based data for the optimization of substance abuse management.

Materials and Methods

Compliance with Ethical Standards

Ethical approval for this study was obtained from the Clinical Research Ethics Committee of University of Health Sciences Türkiye, Basaksehir Cam and Sakura City Hospital (approval no.: KAEK/24.07.2024.135, date: 19.08.2024). The study was conducted in accordance with the principles outlined in the Declaration of Helsinki.

Study Design and Participants

This retrospective study analysed urine drug screening results from 8,051 individuals tested between 1 January 2020 and 30 June 2024 at the Medical Biochemistry Laboratory of University of Health Sciences Türkiye, Basaksehir Cam and Sakura City Hospital, Türkiye. The data were extracted from the hospital's information management system. Out of the total, 6,006 individuals had valid urine drug screening results, and they were included in demographic evaluations. Among them, 1,516 (25.2%) tested positive, and 4,490 (74.8%) tested negative. 2,045 samples (25.4%) were excluded due to the following reasons:

- Integrity test failure (70.3%, n=1,438)
- Improper transfer/storage conditions (12.8%, n=262)
- Procedural non-compliance (10.1%, n=207)

There were no inclusion or exclusion criteria based on age or gender. The final study population included both inpatients and outpatients, with a wide age range (1-89 years). No personally identifiable information or biological samples were used. Informed consent was obtained from all participants, and chain of custody protocols were strictly applied (Figure 1).

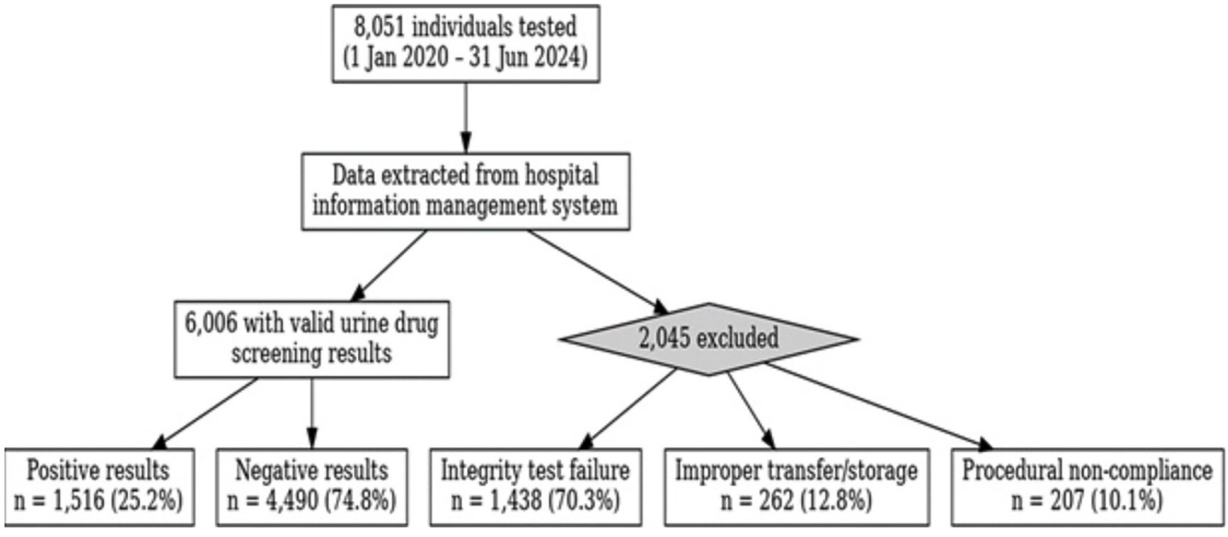

Figure 1. Flow diagram of the retrospective descriptive urine drug screening study

Measures and Procedure

Urine drug analyses targeted both standard panel substances and additional compounds, as follows:

- Standard panel: Amphetamines, cannabis (tetrahydrocannabino), opiates, cocaine and benzodiazepines
- Expanded panel: Synthetic cannabinoids (K2 and K3), barbiturates, buprenorphine and ethyl glucuronide

Testing was performed using a cloned enzyme donor immunoassay with Thermo Scientific kits on the Indiko Plus automated analyser (Thermo Fisher Scientific, Finland). Synthetic cannabinoid analyses were performed using ARK Diagnostics kits.

The cut-off concentrations for the screening analyses were as follows: 500 ng/mL for amphetamines, 50 ng/mL for cannabis, 300 ng/mL for opiates, 300 ng/mL for cocaine, 50 ng/mL for benzodiazepines, 5 ng/mL for synthetic cannabinoids, 200 ng/mL for barbiturates, 5 ng/mL for buprenorphine, and 500 ng/mL for ethyl glucuronide. Results exceeding these thresholds were considered positive, while values below them were considered negative. Outcomes were reported both qualitatively and quantitatively.

All the analyses underwent daily dual-level internal quality control and external proficiency testing. The coefficients of variation for both normal and pathological levels were as follows: amphetamines, 7.8% and 5.2%, respectively; cannabis, 5.2% and 4.5%; opiates, 5.3% and 4.7%; cocaine, 4.8% and 4.4%; benzodiazepines, 3.1% and 3.7%; synthetic cannabinoids, 11.1% and 7.8%; barbiturates, 6.3% and 5.2%; buprenorphine, 10.4% and 14.5%; and ethyl glucuronide, 5.7% and 4.5%.

Urine specimens were collected in designated collection areas. Sample integrity was verified within four minutes of collection via temperature measurement (accepted range: 32°C-37°C). Samples outside this range were excluded. Additional integrity tests included creatinine levels, pH, and oxidant screening.

Statistical Analysis

Categorical variables were summarised using frequencies and percentages, while continuous variables were presented as mean ± standard deviation and median, (minimum-maximum) values. The normality of the continuous variables is determined by using the Kolmogorov-Smirnov test. Comparisons between groups were made using the chi-square test. A p-value below 0.05 was considered statistically significant. All the statistical analyses were conducted using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). No artificial intelligence tools were used for data collection or analysis.

Results

The demographic and clinical characteristics of the patients are presented in Table 1. A total of 6,006 individuals underwent urine substance testing, with a mean age of 31.9±11.7 years (median: 29.0; range: 1-89). Of these, 1,516 patients (25.2%) tested positive for at least one substance.

Table 1. Basic descriptive characteristics of patients and distribution of urine drug screening applications by demographics, clinical departments, and test purpose (n=6006)

	n	%
Year of application		
2020	144	2.4
2021	1026	7.1
2022	1188	19.8
2023	2390	39.8
2024*	1258*	20.9*
Gender		
Male	4705	78.3
Female	1301	21.7
Age group		
<10 years	14	0.2
10-17 years	167	2.8
≥18 years	5825	97.0
Requesting department		
Psychiatry outpatient clinic	2242	37.3
Psychiatry service (male)	1432	23.8
Psychiatry service (female)	831	13.8
EPOC	631	10.5
Psychiatry consultation	441	7.3
Pediatric emergency	134	2.2
Adult emergency	102	1.7
Intensive care	30	0.5
Pediatric service	30	0.5
PEM	18	0.3
Pediatric intensive care	12	0.2
Pediatric psychiatry consultation	12	0.2
Pediatric psychiatry	7	0.1
OAOCS	84	1.4
Inpatient/outpatient		
Inpatient	2329	38.8
Outpatient	3677	61.2
Test request (forensic and medical)		
Forensic	1089	18.1
Medical	4917	81.9

*The data is up to June 31 2024
n: Number of individuals, %: Percentage, EPOC: Emergency psychiatry outpatient clinic, PEM: Pediatric endocrinology and metabolism, OAOCS: Other adult outpatient clinics and services

The distribution of substance-positive cases by requesting departments is shown in Table 2. The highest positivity rates were observed in psychiatry services, psychiatry consultations, and emergency psychiatry outpatient clinics, whereas paediatric departments accounted for the lowest proportion.

According to Table 3, benzodiazepine positivity was significantly higher in females (14.5%) compared with males (7.2%) odds ratio (OR)=21.4; 95% confidence interval (CI): 16.55-27.75), while amphetamine positivity was significantly higher in males (7.8%) compared with females (5.0%) (OR=1.609; 95% CI: 1.22-2.11). No statistically significant difference was observed in overall positivity between genders (p=0.103).

The bar chart shown in Figure 2 illustrates the distribution of the detected substances categorized by gender (female and male) and overall percentage. Benzodiazepines were the most frequently detected substance, with the risk of use being 21.4 times higher in females compared to males (OR=21.4; 95% CI: 16.55-27.75). Conversely, the likelihood of amphetamine use was significantly higher in males than in females, with an odds ratio of 1,609 (95% CI=1.22-2.11) (Figure 2).

The comparison between adolescents and adults is summarised in Table 4. No significant difference in overall positivity rates was observed (27.1% vs. 25.2%; p=0.560). Benzodiazepine use was more prevalent among adolescents, whereas amphetamines, opiates, and cocaine were more common among adults.

Benzodiazepine use was observed in both age groups, but it was more prevalent among adolescents, whereas positivity for amphetamines, opiates, and cocaine was more common in adults. Certain substances, such as buprenorphine and opiates, were not detected in the adolescent group (Figure 3).

Finally, Table 5 demonstrates the distribution of polysubstance use. Polysubstance use was identified in 239 patients, corresponding to 3.97% of the total sample and 15.8% of substance-positive cases. Most cases involved two substances, while a smaller proportion involved three or more. There was no significant difference in polysubstance use between adolescents and adults (p=0.110).

Table 2. Distribution of positive urine drug screening results by requesting department

Department	n	(%)*
Psychiatry service (male)	508	33.5
Psychiatry consultation	271	17.9
EPOC	266	17.5
Psychiatry service (female)	213	14.1
Psychiatry outpatient clinic	110	7.3
Adult emergency	74	4.9
Pediatric emergency	42	2.8
Other clinics and services	11	0.7
Intensive care	9	0.6
PEM	4	0.2
Pediatric intensive care	4	0.2
Pediatric service	3	0.2
Pediatric psychiatry consultation	1	0.1
Pediatric psychiatry	0	0

*Percentages were calculated based on 1.516 positive tests
n: Number of individuals, %: Percentage, EPOC: Emergency psychiatry outpatient clinic, PEM: Pediatric endocrinology and metabolism

Table 3. Distribution of positive urine drug screening results by substance type and gender (n=6006)

	Total (n=6006) n (%)	Male (n=4705) n (%)	Female (n=1301) n (%)
Substance Positive*	1516 (25.2)	1165 (24.8)	351 (27.0)
Benzodiazepine	527 (8.8)	339 (7.2)	188 (14.5)
Amphetamine	432 (7.2)	367 (7.8)	65 (5.0)
Cannabinoid-THC	232 (3.9)	189 (4.0)	43 (3.3)
Synthetic Cannabinoid K2-3	88 (1.5)	74 (1.6)	14 (1.1)
Ethyl Glucuronide	64 (1.1)	52 (1.1)	12 (0.9)
Opiate	63 (1.0)	55 (1.2)	8 (0.6)
Cocaine	51 (0.8)	49 (1.0)	7 (0.5)
Buprenorphine	33 (0.5)	25 (0.5)	8 (0.6)
Barbiturate	9 (0.1)	7 (0.1)	2 (0.2)

*Indicate the most frequently detected substance in each gender group
n: Number of individuals, %: Percentage, THC: Tetrahidrokannabinol
K2-3: Spice

Discussion

This study analysed data from 6,006 patients who underwent urine drug screening. The majority of patients were male (78.3%); 97% of them were aged 18 or older, and the mean age was 31.9 years. These findings underscore the ongoing public health challenge of substance use, particularly among adults. The results align with the 2022 National Survey on Drug Use and Health (NSDUH) by SAMHSA, which reported that 48.7 million individuals (17.3%) aged 12 or older experienced substance use disorders, including 29.5 million with alcohol use disorder and 27.2 million with drug use disorder (11,12). These statistics highlight the widespread prevalence of substance use and the urgent need for targeted treatment interventions.

In this study, a five-year analysis was conducted on test requests. The findings show fluctuating numbers, with a marked increase in 2023 (39.8%) and the lowest in 2020 (2.4%). This rising trend suggests increasing demand

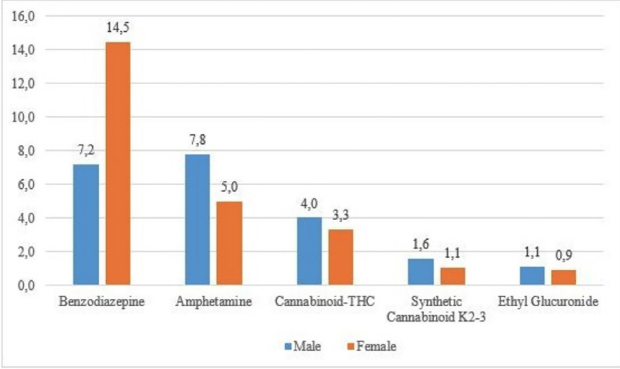

Figure 2. Gender-based comparison of the five most frequently detected substances in urine drug screening

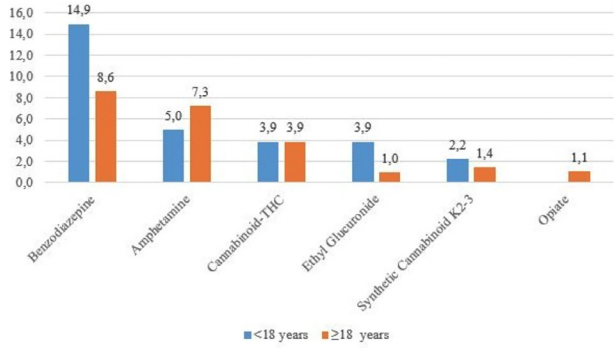

Figure 3. Substance positivity in urine drug screening by age group: adolescents vs. adults

Table 4. Comparison of substance positivity rates in urine drug screening between adolescents and adults

	<18 age (n=181) n (%)	≥18 age (n=5825) n (%)
Substance Positive*	**49 (27.1)**	**1467 (25.2)**
Benzodiazepine	27 (14.9)	500 (8.6)
Amphetamine	9 (5.0)	423 (7.3)
Cannabinoid-THC	7 (3.9)	225 (3.9)
Synthetic Cannabinoid K2-3	4 (2.2)	84 (1.4)
Opiate	-	63 (1.1)
Ethyl Glucuronide	7 (3.9)	57 (1.0)
Cocaine	1 (0.6)	50 (0.9)
Buprenorphine	-	33 (0.6)
Barbiturate	1 (0.6)	8 (0.1)

*Indicates the overall positivity rate for any tested substance within each age group.
n: Number of individuals, %: Percentage, THC: Tetrahidrokannabinol
K2-3: Spice

Table 5. Distribution of polysubstance use by age, gender, and number of substances detected

	n	(%)
Polysubstance Use	239	4%*/15.8%#
Gender Distribution		
Male	189	4%+/16.2%ᵣ
Female	50	3.8%⊥/14.3%&⊥
Age Distribution		
<18	4	2.1%ᵡ/1.4%ᵑ
≥18 years	235	4.0%ᵚ/3%ᵝ
Age & Gender		
<18 years Female	4	1.7%
<18 years Male	-	-
≥18 years Female	46	19.3%
≥18 years Male	189	79.1%
Number of Substances Used		
Dual	196	82.0%
Triple	38	15.9%
Quadruple	4	1.67%
Quintuple	1	0.42%

n: Number of İndividuals, (%): Percentage, #Substance-Positive Patients, +All Males, ᵣSubstance-Positive Males, ⊥All Females, &Substance-Positive Females, ᵡSubstance-positive patients under 18, ᵑ of all patients under 18, ᵚsubstance-positive patients aged 18 and over, ᵝall patients aged 18 and over

for psychiatric care, possibly influenced by the long-term psychological effects of the coronavirus disease-2019 pandemic, economic stressors, and growing mental health awareness. The significant rise from 2020 to 2022 aligns with studies documenting the pandemic's impact on mental health (13). The low case numbers in 2020 may also reflect the recent implementation of screening in our laboratory, which had yet to gain widespread recognition in healthcare settings.

The majority of test requests originated from the psychiatry outpatient clinic (37.3%) and the male psychiatry service (23.8%). The predominance of male patients in test requests may suggest a higher clinical detection rate of substance use among men. Additionally, 61.2% of the patients were outpatients, indicating a substantial demand for outpatient treatment services. These results are consistent with a study conducted in Jordan, which also reported a higher prevalence of substance use disorders among male patients receiving outpatient psychiatric care (14).

An important finding of this study is that 18.1% of the substance screening tests were conducted for forensic purposes, while 81.9% were done for medical reasons. This highlights the predominant role of clinical evaluations in identifying substance use and points to the need for health policies that prioritise medical intervention over legal processing.

These results are consistent with SAMHSA's 2022 NSDUH report, which emphasized the need for accessible outpatient treatment services (5). Similarly, the 2023 European Drug Report by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) identified outpatient services as the primary mode of treatment for substance use disorders across Europe. Expanding access to outpatient care has been shown to ease the burden on inpatient facilities (2), and our findings further support the development of comprehensive outpatient programmes.

Notably, 10.5% of our cases involved emergency psychiatric services, underscoring the need for crisis intervention strategies and enhanced community-based mental health programmes to reduce dependency on emergency care. Recent studies support this interpretation and contain similar recommendations (15,16).

A noteworthy gender-related finding of the present study is that the rate of substance positivity was slightly higher among women (27%) than men (24.8%). Benzodiazepines were the most frequently detected substances in women, whereas amphetamines were more common in men. The higher prevalence of benzodiazepine use among women may be influenced by their longer life expectancy and greater engagement with healthcare services (17,18). Several scholars have reported a female-to-male ratio of 3:1 for benzodiazepine misuse in primary healthcare settings (19). In a study conducted in Porto, the authors found that older women, particularly those who were divorced or widowed, were at higher risk of benzodiazepine misuse (20).

According to our findings, benzodiazepine positivity was higher in women, while amphetamine positivity was higher in men; these results are also consistent with other studies conducted in Türkiye.

At Ankara Bilkent City Hospital, benzodiazepines, cannabinoids, and amphetamines were reported as the most frequent substances, with clear gender- and age-related differences (21). Similarly, Öğüt and Yıldırım (22) found that benzodiazepine and amphetamine use was more common among women, while cannabinoids were more prevalent among men.

Our findings are consistent with these studies, but the lower cannabinoid rate in our cohort may reflect regional differences in substance availability or testing practices. Overall, these results emphasise the importance of gender-sensitive prevention and treatment strategies.

Amphetamine use appears to be more prevalent among men, which is consistent with our findings. According to the 2024 European Drug Report, approximately two million adults used amphetamines in the year preceding the report's data collection, with a higher incidence among men (2). Paz-Ramos et al. (23) also reported widespread misuse of amphetamine-type stimulants, particularly among male users.

In our study, substance positivity was slightly higher among individuals under 18 (27.1%) compared to adults (25.2%); however, this difference was not statistically significant (p=0.560). Benzodiazepines were the most commonly detected substances across both age groups, possibly reflecting prescribing practices and potential misuse. The 2021 NSDUH reported the highest rates of substance use disorders among young adults aged 18-25, which emphasizes the need for targeted prevention strategies. Bushnell et al. (24) noted a rising trend in diagnoses of sedative, hypnotic, or anxiolytic use disorders among both prescribed and non-prescribed users, especially young adults. These results underscore the need for improved prescription monitoring and public education regarding the risks of misuse.

In addition, our data showed that substance positivity was slightly higher in adolescents compared to adults, with benzodiazepines being the most frequently occurring substances in this age group. In adults, however, amphetamines, opiates, and cocaine were more common. Survey-based studies in Türkiye have reported a growing use of amphetamine-type stimulants among young people, particularly in metropolitan areas (25). This pattern suggests that adolescents may often initiate substance use with sedatives, while with increasing age, there is a shift toward stimulants and opiates, which carry higher risks of dependence.

A key finding of our study is that 239 patients (3.97%) engaged in polysubstance use, which accounted for 15.8% of the substance-positive individuals. Although polysubstance use was more prevalent among males, a notable number of female and underage patients also exhibited it. This warrants further attention to gender- and age-specific risk factors. Data from recent studies support our results as they show that approximately 72.7% of women use two or more substances on a daily basis, including cocaine, opioids, cannabis, alcohol, benzodiazepines and nicotine (26). These results highlight the need for tailored interventions that address women's unique risks and usage patterns.

While men generally have higher rates of substance use, women often progress more quickly from initial use to dependence and may experience more severe consequences. This phenomenon, known as the telescoping effect, underscores the necessity for gender-sensitive prevention and treatment strategies (27).

Polysubstance use, which involves the concurrent use of illicit drugs, alcohol and prescription medications, is now the predominant pattern of substance use in Europe, especially among younger populations (28). In the United States (US), SAMHSA and NSDUH data indicate that 81% of individuals misusing opioids also consume other substances (29). This complexity presents significant challenges for diagnosis and treatment.

Polysubstance use patterns differ across regions. According to the EMCDDA, opioids, benzodiazepines, and stimulants are commonly co-used in Europe, while NSDUH data from the US identify alcohol, cannabis, and cocaine as substances typically co-used with opioids (29). These regional differences highlight the importance of locally relevant harm reduction and treatment strategies.

In our cohort, polysubstance use was identified in 15.8% of substance-positive individuals, most frequently involving the concurrent use of two substances. Recent evidence also indicates that polysubstance users are at higher risk of psychiatric comorbidities and treatment resistance (30). This highlights the necessity of early recognition of polysubstance use in clinical practice and the adaptation of treatment plans accordingly.

Study Limitations

Despite offering valuable insights into urine drug screening, this study has several limitations. First, the study was conducted in a single healthcare institution; hence, the generalizability of the findings to wider populations may be limited. Second, while urine drug screening tests are effective for the initial detection of substance use, they do not differentiate between acute and chronic use, nor do they precisely determine the timing of substance intake. Additionally, the study did not include a detailed assessment of the patients' clinical histories or psychosocial factors, which limited our ability to fully explore the underlying causes and contexts of substance use. Despite these limitations, this study is strengthened as one of the few large-scale investigations in this field, through the use of standardized laboratory methods in accordance with national regulations and circulars, and because such studies are very limited in number but provide highly valuable contributions.

Conclusion

This retrospective analysis of urine drug screenings at University of Health Sciences Türkiye, Basaksehir Cam and Sakura City Hospital documents critical trends in substance use, including higher positivity rates among females, particularly for benzodiazepines, and a notable prevalence of polysubstance use, predominantly among adults. Most of the test requests originated from psychiatric services, reflecting the integral role of mental health care in substance use detection and management. While medical screenings made up the majority of the tests, forensic evaluations also played a meaningful role.

The findings emphasise the importance of regulatory-compliant laboratory practices, effective prescription monitoring and widespread public awareness in shaping health policy, updating clinical guidelines and improving prevention, screening and treatment approaches. Given the growing prevalence of polysubstance use and distinct gender-related risks—especially among young adults and women—tailored, gender-sensitive interventions are essential to mitigate the rising burden of substance use disorders.

Ethics

Ethics Committee Approval: The Clinical Research Ethics Committee University of Health Sciences Türkiye, Basaksehir Cam and Sakura City Hospital, provided the necessary ethical permissions for the investigation with (approval no.: KAEK/24.07.2024.135, date: 19.08.2024).

Informed Consent: Informed consent was obtained from all participants.

Footnotes

Financial Disclosure: This study received no financial support.

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