

# Neurotoxicological manifestations among drug abusers admitted to Alexandria poison unit and Al-Mamora hospital: prospective study

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## Abstract

**Background:** Neurotoxicity is a significant contributor to neurodegenerative disorders, often linked to drug abuse, a critical issue affecting Egyptian youth during their productive years. The aim of the study was: a) To describe the neurotoxic effects of acute and chronic use of drugs of abuse in patients admitted to Alexandria poison unit (APU) and Al-Mamora hospital addiction treatment unit (MH), b) To evaluate them regarding age, sex, education, residency, marital status, cause, family history, past history and study the presentation, pattern of abuse, relapse, identify the risk factors, and c) To assess facilities to prevent further morbidity and mortality.

**Methods:** A prospective study was conducted on all patients with neurotoxicological manifestations due to drug abuse admitted to APU and MH from June 1<sup>st</sup> to December 31<sup>st</sup>, 2020. Data collected included demographics, full history of medications, mental and neurological examinations, and investigations.

**Results:** Among 242 patients, drug abuse spanned both sexes and all age groups. Most patients were single, educated, unemployed, or working in skilled labor. Smoking and repeated relapses were common, highlighting the chronic and challenging nature of drug abuse.

**Conclusion:** Drug abuse is a persistent problem requiring community awareness and collaboration among ministries. A targeted healthcare program with preventive and curative measures is essential to mitigate its impact.

**Keywords:** Neurotoxicity, Drug abuse, Poisoning

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## INTRODUCTION

Neurotoxicity is considered a major cause of neurodegenerative disorders. Any adverse effect on the structure or function of the nervous system produced by a biological, chemical, or physical agent is neurotoxicity (1). Most drugs of abuse have non-negligible neurotoxic effects, many of which are primarily mediated by several dopaminergic and glutamatergic neurotransmitter systems (2).

Substance abuse-related problems are one of the emerging multidimensional epidemics of modern times. Problematic use of alcohol, tobacco, and illicit drugs is the leading cause of preventable deaths and disability in many countries around the world. As drugs impact every sector of society, they closely contact and contend with political, ethical, moral, legal, public safety, and economic issues, nationally and internationally (3).

In Egypt, drug abuse is one of the most serious problems that worry the Egyptian government, as it deals with young people within the age of work and productivity. It may lead

to many problems, such as bad social adaptation, decreased work productivity, or job dismissal (4).

Substance misuse and neuropsychiatric diseases entail intricate connections between different brain areas and neurotransmitter systems at the cellular and molecular levels. Changes in neural plasticity, gene expression, and synaptic transmission can result from the dysregulation of these systems, which can then change behavior and brain function (5).

The aim of the study was to describe the neurotoxic effects of acute and chronic use of drugs of abuse in patients admitted to the APU and MH addiction treatment unit throughout 6 months. To study the presentation, pattern of abuse, and relapse. Finally, to identify the risk factors to prevent further morbidity and mortality.

## METHODS

### Patients

A prospective observational study was carried out on all poisoned patients with drugs of abuse admitted to the APU,

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and all drug abusers admitted to the MH addiction treatment unit within 6 months of the study (who were eligible for exclusion and inclusion criteria), from June 1<sup>st</sup> to December 31<sup>st</sup>, 2020.

Inclusion criteria:

- Admitting drug intake.
- Signed informed consent for research.

Exclusion criteria:

- If patients escaped from the hospital before discharge.
- Medical and surgical emergency.
- Underage with no relative to give informed consent.

## Method

### Informed consent

Informed consent was obtained from the patient after a clear elaboration of detailed information. Adolescents aged approximately 13–18 were recruited and provided signed assent for their own participation. The ethical approval before starting the study was obtained from the ethical committee of Alexandria University. (IRB NO: 00007555, FWA NO: 00018699).

**All patients were subjected to the following**

### History taking

All patients assessed for:

- personal data and demographic data
- full history of medications and mode of exposure
- detailed history of drug abuse and relapse
- smoking history
- criminal history
- past history

### Examination

- General examination
- Full neurological examination
- Mental state examination

### Lab investigations

Routine investigations and specific laboratory investigations regarding substances of abuse were done.

### Statistical analysis

The data were collected and stored on a personal computer. Statistical analysis was done using Statistical Package for Social Sciences (SPSS/version 20) software. Data were expressed as mean and standard deviation (SD). They were analyzed using Statistical Package for Social Sciences (IBM SPSS) software package version 20. Arithmetic mean, standard deviation, for categorized parameters, the chi-square test was used, while for numerical data, a t-test was used to compare two groups. A p-value of  $\leq 0.05$  was considered statistically significant.

**Ethical Considerations:** the Institutional Review Board, Faculty of Medicine, Alexandria University, approved the study. Confidentiality of data was maintained and used only for the purpose of epidemiological analysis.

## RESULTS

A total of 242 patients were admitted to both hospitals over a period of six months during the study period. Two hundred patients were admitted to APU (82.6%), and the rest to the MH addiction unit.

### Demographic data of the studied patients

### Age and sex of the studied patients

The study found a male-to-female ratio of 3:1 in APU and 5:1 in MH, with most patients (48%) in their third decade of life (Table 1).

**Table 1. Demographic data of the studied patients in Alexandria poison unit and Al-Mamora hospital addiction unit**

	Group I "Poison unit" (n = 200)	Group II "Al-Mamora" (n=42)	p
Personal data	No. [%]	No. [%]	
Sex			
Male	154 [77%]	35 [83.3%]	0.366
Female	46 [23%]	7 [16.7%]	
Age			
<20	45 [22.5%]	3 [7.1%]	0.132
20 - <30	94 [47%]	22 [52.4%]	
30- <40	34 [17%]	17 [40.5%]	
≥ 40	27 [13.5%]	0 [0.00%]	
Range	1.0 – 57.0	18.0-36.0	0.107
Mean ± SD	25.99 ± 11.05	29.8±9.25	
Education			
Illiterate	62 [31%]	12 [28.6%]	0.858
educated	110 [55%]	25 [59.5%]	
Highly educated	28 [14%]	5 [11.9%]	
Occupation			
Unemployed	118 [59%]	5 [11.9%]	0.013*
Manual worker	31 [15.5%]	11 [26.2%]	
Skilled worker	36 [18%]	16 [38.1%]	
Professional	15 [7.5%]	10 [23.8%]	
Marital status			
Married	53 [26.5%]	6 [14.3%]	0.106
Single	136 [68%]	28 [66.7%]	
Divorced	10 [5%]	8 [19.0%]	
Widow	1 [0.5%]	0 [0.0%]	
Residence			
Urban	180 [90%]	34 [81.0%]	0.365
Rural	20 [10%]	8 [19.0%]	
Patient criminal history			
Yes	70 [35%]	6 [14.3%]	0.110
No	130 [65%]	36 [85.7%]	
Smoking			
Yes	133 [66.5%]	42 [100.0%]	0.025*
No	67 [33.5%]	0 [0.0%]	
Number of packets smoked per day			
Range	1 – 7	1-6	0.231
Mean ± SD	1.74 ± 1.97	1.92±1.56	

X<sup>2</sup>: Chi-square test

\*: Statistically significant at p ≤ 0.05

**Table 2. Distribution of studied patients according to type of substance abused in Alexandria poison unit and Al-Mamora hospital**

	Group I "Poison unit" (n = 200)	Group II "Al-Mamora" (n = 42)	p
Substance used	No. [%]	No. [%]	
1- Opioid			
a- Heroin	5 [2.5%]	31 [73.8%]	0.001*
b- Tramadol	23 [11.5%]	33 [78.6%]	0.001*
2- Sedative hypnotic			
• Benzodiazepine	34 [17.0%]	18 [42.9%]	0.023
3- Alcohol	78 [39.0%]	3 [7.1%]	0.006*
4- CNS stimulant			
Amphetamine	11 [5.5%]	0 [0.0%]	0.107
5- Cannabis	23 [11.5%]	32 [76.2%]	0.002*
6- Hallucinogens	20 [10.0%]	0 [0.0%]	0.003*
7- Inhalants	5 [2.5%]	2 [4.8%]	0.254
8- Anabolic Steroids	1 [0.5%]	0 [0.0%]	0.44
Total	200 [100%]	42 [100.0%]	

X<sup>2</sup>: Chi-square test

\*: Statistically significant at p ≤ 0.05

#### Level of education of the studied patients

Over half (56%) of the patients were educated, 30.5% were illiterate, and 13.6% had high school or university education, with no significant differences between the two hospitals (Table 1).

#### Occupation of the studied patients

In APU, 59% of patients were unemployed, 18% were skilled workers, and 15.5% were manual workers, while in MH, 38.1% were skilled workers and 26.2% were manual workers, showing a significant difference (Table 1).

#### Marital status of the studied patients

The majority of the patients were single (n=164, 68%). However, there was no significant difference between single, married, widowed, and divorced patients (Table 1).

#### Residence of the studied patients

88.4 % of the studied patients lived in urban areas (n=214) (Table 1).

#### Criminal history of the studied patients

65% of patients admitted to APU and 85.7% of patients admitted to MH had no criminal history (Table 1).

#### Smoking habits of the studied patients

All of the patients admitted to MH were smokers (number of packets per day ranged from 1-6), while 66.5% of patients admitted to APU smoked (number of packets per day ranged from 1-7). There was a significant difference between the two hospitals (Table 1).

#### Distribution of studied groups according to type of drug of abuse

At APU, 39% of patients suffered acute alcohol poisoning, 17% benzodiazepine poisoning, 11.5% cannabis or tramadol poisoning, 10% hallucinogen poisoning, 5.5%

amphetamine poisoning, and 2.5% heroin or inhalant poisoning. At MH, 78.6% abused tramadol, 76.2% cannabis, 73.8% heroin, and 42.9% benzodiazepines, with less than 10% abusing alcohol or inhalants. More heroin, tramadol, and cannabis abusers were admitted to MH, while APU had significantly more cases of acute alcohol and hallucinogen poisoning (Table 2).

#### Relation between types of substance abuse and age and sex in the studied patients admitted to APU

Most females used CNS stimulants (81.8%) and sedative-hypnotics (79.4%), significantly more than opioids (25%). Among males, cannabis (100%), alcohol (98.7%), inhalants (100%), and hallucinogens (95%) were significantly higher compared to sedative-hypnotics (20.6%) and CNS stimulants (18.2%) (Table 3).

By age, opioid use was highest among patients in their third decade (64.3%) compared to alcohol (50%) and CNS stimulants (27.3%). Conversely, patients above 40 showed higher use of CNS stimulants (27.3%) and alcohol (19.2%) compared to opioids (3.6%) (Table 3).

#### Distribution of studied groups according to pattern of drug abuse and relapse

In APU, 91% of cases abused drugs without a physician's prescription, with a mean duration of 74.22 ± 24.12 months, compared to 68.11 ± 28.66 months in MH.

Among daily abusers, 45% in APU took drugs twice daily, while 35% in MH used them three times daily (Table 4). In APU, 26% of daily abusers tried quitting multiple times versus 78.5% in MH. The primary reason for quitting in both groups was adverse health effects, with most attempting to quit over five times. Relapses were mainly due to peer influence and psychological issues (Table 5).

#### Distribution of studied cases according to the mode of poisoning in patients admitted to the APU

The majority of the cases (66%) admitted to APU were abusers suffering an overdose, 18.5 % committed suicide, 11.5% were accidental intake, and 4% (8 cases) were given drugs by friends.

#### Signs and symptoms of drug of abuse suffered by patients admitted to APU and MH

The majority of the studied cases admitted to the APU (n=120; 60%) complained mainly from disturbed levels of consciousness, while 28% were admitted with coma. 12% suffered mainly nausea, vomiting, and hypotension. All the patients improved, and only one died of alcohol poisoning.

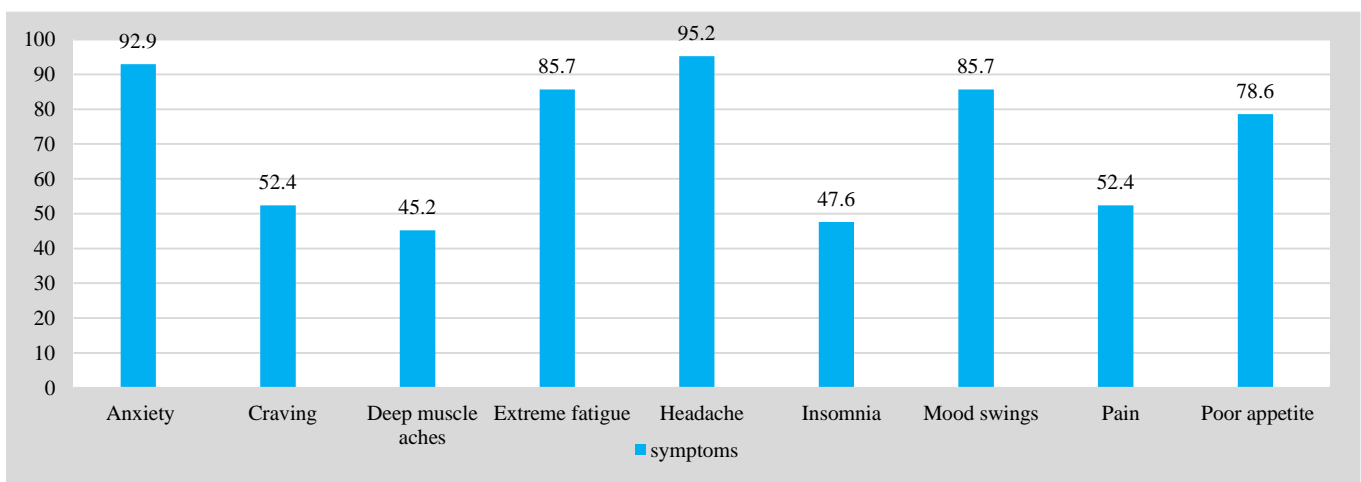
The most common symptoms suffered by abusers admitted to MH were headaches, anxiety, mood swings, extreme fatigue, poor appetite, cravings, pain, and insomnia (Figure 1).

Patients admitted to the APU with an overdose of opioids (heroin and tramadol) were mainly admitted with CNS depression in the form of coma with constricted pupils and hypotension. In cases of acute benzodiazepine poisoning, patients were mainly drowsy, confused with a lack of coordination, or in a coma. They also complained of blurring of vision, slurred speech, and difficulty in breathing. In cases of acute alcohol poisoning, patients mainly suffered changes in mental state, including confusion, depressed or arrested breathing, heart rate, and gag reflex, and sometimes seizures

**Table 3. Relation between types of substance abuse and age and sex in the studied patients admitted to the Alexandria poison unit**

Personal data	Substance abused								Test of sig.
	Opioid (n = 28) No. %	Sedative hypnotic (n = 34) No. %	Alcohol (N=78) No. %	CNS stimulant (n = 11) No. %	Cannabis (n = 23) No. %	Hallucinogen (n = 20) No. %	Inhalants (n = 5) No. %	Steroids (n = 1) No. %	
<b>Sex</b>									
Male	21 [75.0%]	7 [20.6%]	77 [98.7%]	2 [18.2%]	23 [100.0%]	19 [95.0%]	5 [100.0%]	0 [0.0%]	MCp <0.001*
Female	7 [25.0%]	27 [79.4%]	1 [10.0%]	9 [81.8%]	0 [0.0%]	1 [5.0%]	0 [0.0%]	1 [100.0%]	
FEp <sub>1</sub>		<sup>2</sup> p <0.001*	<0.001*	0.003*	0.012*	0.116*	0.559	0.276	
FEp <sub>2</sub>			<0.001*	1.000	<0.001*	<0.001*	0.001*	1.000	
FEp <sub>3</sub>				<0.001*	1.000	0.368	1.000	0.025*	
FEp <sub>4</sub>					<0.001*	<0.001*	0.005*	1.000	
FEp <sub>5</sub>						0.465	-	0.042*	
FEp <sub>6</sub>							1.000	0.095	
FEp <sub>7</sub>								0.167	
<b>Age</b>									
<20	8 [28.6%]	12 [35.3%]	6 [7.7%]	3 [27.3%]	6 [26.1%]	5 [25.0%]	5 [100.0%]	0 [0.0%]	MCp <0.001*
20 - <30	18 [64.3%]	13 [38.2%]	39 [50.0%]	3 [27.3%]	9 [39.1%]	11 [55.0%]	0 [0.0%]	1 [100.0%]	
30- <40	1 [3.6%]	7 [20.7%]	18 [23.1%]	2 [18.2%]	3 [13.0%]	3 [15.0%]	0 [0.0%]	0 [0.0%]	
≥ 40	1 [3.6%]	2 [5.9%]	15 [19.2%]	3 [27.3%]	5 [21.7%]	1 [5.0%]	0 [0.0%]	0 [0.0%]	
MCp <sub>1</sub>		0.099	0.001*	0.035*	0.093	0.595	0.017*	1.000	
MCp <sub>2</sub>			0.003*	0.301	0.327	0.766	0.100	1.000	
MCp <sub>3</sub>				0.151	0.114*	0.099	<0.001*	1.000	
MCp <sub>4</sub>					0.438	0.484	<0.001*	1.000	
MCp <sub>5</sub>						0.457	0.032*	1.000	
MCp <sub>6</sub>							0.020*	1.000	
MCp <sub>7</sub>								0.167	

MCp: p for Monte Carlo test  
 #: Mann Whitney test  
 \*: Statistically significant at P ≤ 0.05  
 #2: Chi-square for Kruskal Wallis test  
<sup>2</sup> p: p-value for chi-square test  
 FEp: Fisher Exact test



**Figure 1. Distribution of studied cases in Al-Mamora hospital according to main symptoms on admission**

**Table 4. Distribution of studied cases according to the pattern of drug abuse in the Alexandria poison unit and Al-Mamora hospital**

Drug history	Group I "Poison unit" (n = 200)	Group II "Al-Mamora" (n = 42)	P
	No. %	No. %	
<b>Duration of taking drugs (months)</b>			
Range	1.0 – 120.0	3.0 – 170.0	
Mean ± SD	74.22 ± 24.12	68.11 ± 28.66	0.213
Number of times of taking the drug per day	n = 150 %	n = 35 %	
Once	57 [38%]	0 [0.0%]	
Twice	68 [45.3%]	8 [18.60%]	
Three times	21 [14%]	15 [34.88%]	
Four times	4 [2.7%]	11 [25.58%]	
Five times	0 [0%]	1 [2.33%]	
Range	1.0 – 4.0	2-5	
Mean ± SD	1.81 ± 0.77	2.21±0.68	0.107

X<sup>2</sup>: Chi-square test

\*: Statistically significant at p ≤ 0.05

and death.

However, cases of opioid abuse (heroin and tramadol) admitted to MH suffered mainly from craving, extreme fatigue, deep muscle aches, insomnia, poor appetite, and headaches. Benzodiazepine abusers mainly suffered insomnia, muscle pain, weakness, and painful tremors. Alcohol abusers mainly suffered fatigue, mood swings, headaches, alcoholic cerebellar degeneration, and myopathy. The two patients admitted with inhalant abuse mainly suffered aggression and anxiety.

## DISCUSSION

Neurotoxicity is considered a major cause of neurodegenerative disorders. Most drugs of abuse have non-negligible neurotoxic effects, primarily mediated by several dopaminergic and glutamatergic neurotransmitter systems (2). Drug abuse is associated with various neurological manifestations. Clinically, when a patient presents with a neurological or neuromuscular disorder, it is essential to consider drugs as a possible cause (5). Drug addiction produces long-lasting dysfunctions in neurons associated with the brain reward circuitry, and this "functional neurotoxicity" of drugs of abuse leads to vulnerability to relapse and continued drug dependence (6).

Problematic use of alcohol, tobacco, and illicit drugs is a leading cause of preventable deaths and disability worldwide. Drugs impact every sector of society, intertwining with political, ethical, moral, legal, public safety, and economic issues (3). In Egypt, drug abuse is a significant problem affecting young people in their productive years, leading to social maladaptation, decreased work productivity, or job dismissal (4).

A total of 242 patients were admitted during the study period of six months, with 200 admitted to the APU and the rest to the MH. Although patients treated for acute toxicity

**Table 5. Pattern of quitting and relapse in the studied cases in the Alexandria poison unit and Al-Mamora Hospital**

	Group I APU (n = 200)	Group II MH (n = 42)
	No. %	No. %
Quitting the drug	39 [26%]	33 [78.5%]
<b>Reasons for quitting</b>		
1- Sense of guilt	13 [33.3%]	2 [6%]
2- No more addiction effect	4 [10.3%]	9 [27.3%]
3- Bad health effect	22 [56.4%]	22 [66.7%]
<b>Number of times of quitting</b>		
3 – <5	8 [20.5%]	4 [12.1%]
5 or more	31 [79.5%]	29 [87.9%]
Range	3.0 – 30.0	
Mean ± SD	9.18 ± 6.43	
<b>Reasons for relapse to drug abuse</b>		
1- Psychological conditions	9 [23.1%]	15 [45.5%]
2- Regain the state of addiction	11 [28.2%]	6 [18.1%]
3- Effect of peer group	19 [48.2%]	12 [36.4%]

were nearly four times more than those treated for addiction, this may reflect the short hospital stays for acute toxicity cases compared to the longer stays required for addiction treatment or patients not seeking treatment at all.

The study showed a male-to-female ratio of 3:1 in APU and 5:1 in MH. These findings align with the first National Addiction Research Program in Egypt, where the male-to-female ratio was 7:1 (13:1 in Delta and Middle Egypt, 2.7:1 in Cairo, 7:1 in Coastal regions, and 5:1 in Upper Egypt) (7). Similar results were reported in the USA, where men were more likely to use illicit drugs and experience drug-related emergencies or overdoses than women (8). Women progress more rapidly from drug use to addiction, suffer more severe consequences, and often face barriers to accessing treatment due to stigma (9).

In Egypt, social and familial protections may limit women's drug use compared to men (10). Females are more prone to internalizing issues, such as anxiety and depression, while males are more likely to experience externalizing problems, including substance use and aggression (11). Fonseca et al. (2021) highlighted that addiction stigma significantly hinders treatment access, intensifying both structural and personal barriers to care (9).

Most patients (48%) were in their third decade of life, highlighting the role of life stresses and adjustment difficulties in substance use initiation and escalation (11). Rabie et al. (2020) reported the age of onset for substance use ranged between 17 and 28 years (4).

Education levels varied among patients, with one-third being illiterate, while the rest had high school or university education. El-Sawy et al. (2010) found similar results, reporting that the highest percentage of addicts had secondary education, while illiteracy was lower among addicts than the general population (12). Employment status also varied, with 59% of APU patients being unemployed,



while 38.1% of MH patients were skilled workers, and 26.2% were manual workers. These findings align with studies showing addiction prevalence among workers, especially those with irregular incomes and financial stress (11). A significant difference was noted between the two hospitals regarding addiction prevalence by occupation. El-Sawy et al. (2010) reported the highest rates among manual workers (12), while Hamdi et al. (2016) similarly found substance use and abuse most prevalent among workers, likely due to irregular incomes, financial losses, and social insecurity, which increase stress in this group (11).

Most patients were single (68%). De Espíndola et al. (2020) emphasized the role of interpersonal conflicts and social exclusion throughout life in exacerbating substance abuse (13). Urban residency was predominant (88%), consistent with El-Sawy et al.'s findings of higher drug abuse levels in urban areas (12).

Regarding criminal history, 65% of APU patients and 85.7% of MH patients had no criminal records. However, drug abuse is associated with criminal behavior, varying by drug type. It is found that there is a higher prevalence of binge drinking and a higher prevalence of sedative use than people sentenced to drug crimes (14). All MH patients were smokers, compared to 66.5% in APU; this aligns with Weinberger et al. (2017), who highlighted the strong association between illicit substance use and smoking behaviors (15).

In APU, 39% of patients had acute alcohol poisoning, 17% benzodiazepine poisoning, and 11.5% cannabis or tramadol poisoning. In contrast, MH patients primarily abused tramadol (78.6%), cannabis (76.2%), heroin (73.8%), and benzodiazepines (42.9%). Tramadol and cannabis were the most abused substances overall, consistent with previous studies (4). Egypt is not a significant producer or consumer of narcotics or precursor chemicals, even though opium poppy and cannabis plants are grown in Egypt. The most used substance was nicotine and benzodiazepines (5.1%), followed by alcohol (3.3%), organic solvents (3.1), and cannabis (2.6%). The prevalence of the regular use of any substance was 1.5%, while the prevalence of the dependence syndrome was 0.9% (excluding nicotine dependence) (4). Relapse rates remain high, ranging from 45.33% to 56%, highlighting the chronic nature of addiction (16). Most overdoses were due to abuse, with some cases involving accidental intake, suicide attempts, or drugs given by friends.

From the present study, it was found that males outnumbered females; most males used cannabis, alcohol, inhalants, and hallucinogens, while females preferred sedative-hypnotics and CNS stimulants. This coincides with the research of Rabie et al. (4). Most of the studied patients were abusing drugs without a prescription. They quit the drugs due to bad health effects but relapsed quickly. Nagy et al. (2022) revealed that the relapse rate ranged from 45.33% to 56% (16). The majority of the cases admitted to the APU were abusers suffering an overdose, 18.5% committed suicide, 11.5% were accidental intake, and 4% were given drugs by friends. This can be explained by the fact that drug abuse overdose usually occurs due to intolerance. In case of accidental intake, usually due to lack of supervision.

The neurotoxic effects of drugs vary. Opioids impair

memory across multiple domains (17). Alcohol affects personality, judgment, and motor coordination, with chronic use leading to Wernicke-Korsakoff syndrome and peripheral neuropathy (17, 18). Marijuana is associated with diminished lifetime achievement, psychiatric disorders, and impaired neural development in adolescents (17, 19). Cocaine and stimulants can cause paranoia, psychosis, and seizures (17).

It can be concluded that drug abuse affects both sexes and all ages, predominantly in the productive years of life. Most patients were educated but unemployed or skilled workers and the majority were single. Smokers were more prevalent among abusers, and relapse was common. Most abusers treated for addiction suffered from withdrawal manifestations, and in cases of poisoning, they were mainly abusers suffering from overdose. The main drugs abused by patients treated for addiction were tramadol, cannabis, heroin, and benzodiazepine single or combined, while those treated for overdose, alcohol, benzodiazepines, tramadol, cannabis, and hallucinogens were the main drugs used. Quitting and relapse occurred several times in many patients, so it is a difficult disease to cure that needs community awareness and cooperation of all responsible ministries to eradicate or minimize this problem.

Neurotoxicity is common and should be considered during the diagnosis of neurological disorders. Preventive measures should involve trained personnel, media campaigns, stricter laws, and community efforts to raise awareness and address drug abuse effectively.

## LIMITATION

There were several limitations to this study. First, patients were selected from two main hospitals in Alexandria city and may not be representative of the general Egyptian population. Secondly, most of the history taken depended on the honesty of patients, which was taken as meticulously as possible due to the lack of any computerized patient data in public hospitals. Thirdly, given that the outcome probably reflects resource availability, the outcome in one center may not necessarily be the same outcome in another center.

Based on the findings of the present study, the following recommendations are proposed:

### 1- Preventive measures:

- Specially designed healthcare educational programs for youths should be carried out by trained personnel to show them the effects of drug abuse and avoid glamorization of its effects. In addition, health education about drug abuse should be mandatory and included in all high school programs.
- Special attention should be given to reaching uneducated and manual workers to illustrate the harm of drug abuse.
- The media should play a role in demonstrating the influence of these drugs on health, economy, and social relations.
- Maximizing the punishment of drug dealers and those who import those substances.
- There is an urgent need for effective non-governmental leadership towards a more reasoned approach to drug abuse in this country.
- All patients suspected or proven to suffer from drug abuse problems should be encouraged to join treatment and

rehabilitation programs.

- Screening tests should be obligatory before joining jobs, renewing driving license etc.

2- Investigational measures:

Investigations should not be confined to toxicological emergencies only, but patients should be transferred for a psychological assessment, providing tests for hepatitis and HIV and, if possible, genetic and epigenetic studies.

3- Curative measures:

A- More specialized centers should be available to treat drug abusers with trained physicians and social and psychological providers to offer accurate management and support.

B- Training doctors for the early diagnosis of different drugs of abuse in their patients and ways to guide them to seek proper treatment.

C- Affordable treatment and diagnostic measurement should be available.

4- Clinical guidelines for the treatment of substance abuse should be followed whenever possible.

5- The medical records should be completed and properly preserved to help researchers to solve this problem.

6- Ethical measures: Patients should be assured that their medical reports and data will be kept confidential.

**Ethics Approval:** Approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Alexandria University (IRB NO: 00007555, FWA NO: 00018699).

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**Conflict of Interest:** None to be declared.

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