Original Paper   http://ajol.info/index.php/ijbcs   http://indexmedicus.afro.who.int

Effect of illicit drug use on human behaviors in west Africa: cases of Grand-Bassam (Côte d'Ivoire)

Niemtiah OUATTARA[1,2*], Koffi Mathias YAO[2], Prisca Joelle Djoman DOUBRAN[2],
Ismael Angelo SANOGO[3] and Neme Antoine TAKO[2]

[1]*Department of Neurology, Nanfang Hospital, Southern Medical University, Guangzhou Guangdong, China.*
[2]*Laboratoire de Neurosciences, Université Felix Houphouet Boigny, 22BP 582 Abidjan 22, Côte d'Ivoire.*
[3]*Centre Régional de Formation à la Lutte contre la Drogue, BP 627 Grand-Bassam, Côte d'Ivoire.*
[*] *Corresponding author; E-mail: niemtiah2012@yahoo.fr; Tel. (+86)15626013420 / (+225)0747379841*

ABSTRACT

The use of illicit drug represents a growing danger to social, physical, emotional and job and institutional related problems affecting the well-being of Ivorian youth today. The purpose of this study was to investigated and evaluated the existing knowledge of illegal types of drug usage among youth groups and its associated behavioral disorders and effects in Grand-Bassam district (Côte d'Ivoire). Urine samples were collected from each participant, amongst targeted youth populations for analysis, participants (n=442), age (≥14 years), both genders were randomly selected. Basic information, economic status, and drug usage history were collected using structured questionnaires. Data were analyzed using Python and GraphPad (Prism 8.4.2). Our results finding show that people age 20-35 years with highest illicit drug consumption (57.7%), tetrahydrocannabinol (THC) was the most consumed illicit product, followed by benzodiazepines (BZO) with 92.09% and 24.05%, respectively. The common effects associated with THC use include hallucination, while use of morphine seems to be on steady increase with aggressiveness disorder observed among its users who come more than one illicit drug combinations.
© 2021 International Formulae Group. All rights reserved.

Keywords: Behavioral disorders, illegal substances, drug consumption, health risks, mental health, drug-related harms.

INTRODUCTION

Illicit drug consumption is a significant burden of global mortality worldwide (Ezzati et al., 2002). According to a WHO survey, one of the leading causes of youth deaths is drug addiction. In the United States, Eaton et al. (2006) reported that more than 70% of deaths among people aged 10 to 24 years are homicides and suicides, attributable to accidents (Windle et al., 2008) which may be

related to illicit drug use. At the global level, a study by Jeringan et al. (2001) estimated that more than 5% of deaths among adolescents and young people aged 15 to 29 were due to alcohol abuse. A health study conducted by Darke et al. (2006) concluded that alcohol-attributable mortality would be estimated at 3%, with significant differences depending on age variations, with 20-34 being the most highly impacted age group. Darke et al. (2006) in a study showed that illicit drug use in Western societies was widespread among adolescents, especially the male gender. Moreover, in several countries worldwide, the phenomenon of gender consumption is seen in the youngest cohorts, as the latter cohorts represent higher levels of illicit drug use (Degenhardt et al., 2008).

More than 750.000 people have died from an illicit drug overdose in the United States from 2017 to 2018, according to Wilson et al. (2020). During adolescence, the brain's neurophysiology and learning and exploitation period develops (Berk, 2006). This study was supported by Lanctot et al. (2003), who showed that illegal acts, behavioral disorders and reprehensible demeanors increased during adolescence. Generally, the risk of initiation into the consumption of illicit substances is concentrated in the middle and late teens (Fineberg et al., 2013). In the quest for freedom and independence, many young people are engaged in illicit drug usage. Increasingly, West African countries have been severely affected by using illicit drug trafficking in the previous years. The variety and scale of these criminal activities seriously threaten any efforts to stabilize the political and social establishments in the region. Nowadays, in a phase of anxiety, African countries opt to respond to this continent's illicit drug traffic problem, apparently concentrated mainly in West Africa (Kavanagh et al., 2013). Given the increase in the consumption of illicit substances among certain people and the effects therefrom, Côte d'Ivoire is experiencing

an extraordinary development of illicit drug problems, which exacerbates the level of insecurity and instability in an already troubled country. The military-political crisis crosses over ten years, and the rate of low literacy and lack of awareness of this social group has increased the proportion of the illicit drug in Cote d'Ivoire. Some observations report that young people are among these consumers (Ouattara et al., 2018). There is a real problem that not only involves parents but also requires the contribution of all. Thus, the present study seeks to investigative the extent of information available to the target population and indeed the general public on the impact of illicit substance abuse on the overall peace and stability of society; assess the level of knowledge of relevant regulatory government agencies of these adverse effects and ipso facto, stem the tide of abuse and finally, to identify the age group and drug class most commonly abused as well as influencing factors with the view of ensuring most effective control regimes and interventions in the future.

MATERIALS AND METHODS
Study population

Participants aged between 14 years and above from Grand-Bassam district, located in the southern region of Côte d'Ivoire. The participants were divided into three main categories, whose age ranges from [14-19], [20-35], and [> 35] years old based on the previous epidemiological research questionnaire by Ouattara et. (2018). During six months (02-10-2016 to 31-03-2017) of the survey, 442 participants were selected to participate in this illicit drug consumption quest in the << Centre Régional de Formation à la Lutte Contre la Drogue (CRFLD) >> health organization, located in Grand-Bassam (Côte d'Ivoire). Among these participants, 89.6% were male. 6.52% of females and 93.47% of men consumed at least one substance, while 9.27% of the participants were non-consumers.

Technical material

The technical material is essentially composed of consultation documents of the CRFLD, a precise and straightforward questionnaire and a computer for recording the data.

Analytical material

The urine samples were collected from all participants using a sterilized urine container and reagents for different types of drugs, test tubes, and absorbent paper used to collect washing fluids and stored at 4^0C for <24hours. The laboratory analytical equipment for identifying substances was essentially composed of tips of the analyzers equipment and strips, including a scale for weight gain in the CRFLD,' ELISA quality', microtitre plates with flat-bottomed wells, equipment used in the ELISA chain. A sterilized urine container is used to collect the patient's urine, including reagents for different types of drugs, test tubes, and absorbent paper to collect washing fluids.

Screening of drugs

To carry out this study, a survey was conducted in the above-mentioned health organization (CRFLD) to determine the rate of substance consumers. Subsequently, participants who meet specific criteria defining drug addict by multi-drug urine test (10 in 1) were considered for this study. The testing initially consisted of taking the subject's weight at the CRFLD, followed by a preliminary health check. The screening was done to determine the quality and quantity of substances consumed by an individual.

Qualitative method

Multi-drug urine test (10 in 1) allows urinary screening, which can simultaneously detect the type of medication the individual has accumulated in his body over a period of time was used to produce by (NarcoCheck, France). It is made up of a plastic case, using strips at the extreme, and each strip depicts a specific substance. This test is done by immersion in a sample of fresh urine from the individual to be tested. The urine was then put in a sterile pot, and insert the strips into the container. About 5 minutes later, the strip is then removed from the sterilizing pot, and immediately we subject the results for observation. Negative result means the band shows two red lines, and it is concluded that the patient did not use any substances. In the same way, positive result indicates a single red line, and finally, when it does not appear a red line, the test is invalid and must be repeated or discarded. The protective box allows the result to be read.

Quantitative testing

Quantitative testing was performed to assess the amount of drugs in a participant's body. Using the chain of Enzyme-Linked Immunosorbent Assay (ELISA) test, this technique is an immuno-enzymatic detection technique that allows visualizing an antigen-antibody reaction; it was carried out through a colour reaction produced by the action on a substrate of an enzyme probably fixed to the antibody. The test procedure consists of four main steps: the fixation of the antigen, the fixation of the antibody to be dosed, the fixation of the detection antibody and finally, the revelation stage that allows the specific substrate to be incubated to the enzyme and induce a blue coloration (concentration of antibodies)

Data collection

Data used in the analysis were collected from participants from local health organization (CRFLD). The variance included weight, sex, age group, test results, and effects in each subgroup category**.** The data collected during this survey were preprocessed in Microsoft Excel (version 2016); afterward, the data analysis and visualization were done using Python software and GraphPad (Prism 8.4.2).

Data analysis

Participants who consumed a single type of illicit drug (mono-consumers) were

compared with those who consumed more than one type of illicit drugs in each subgroup. On the other hand, their respective effects were also further compared. Thus, the possible differences between the constituted subgroups (example: Male-Female) were compared. The main statistical tests used were based on one-way ANOVA and One-sample t-test. And the Statistical significance was determined as $P<0.05$ for all statistical procedures.

Ethical consideration

This study was approved by the ethical department of Felix Houphouet Boigny University of Cote d' Ivoire (Abidjan) and written consents from all the participants.

RESULTS

In this study, a total of participants (K=442) was identified who met the criteria for potential inclusion. Specimens were excluded for patients with a disease no relative to illicit drugs and less than 14 years. The participants were categorized into different groups, aged from 14 to 35 years and above. Majority of participants were among the [20-35] years (55.65%) (k=246), followed by a lesser aged group [14-19] years (37.78%) (k=167) and later followed by [> 35] years old (6.56%) (k=29). Specimens with abnormal specimen validity testing and negative drug results (34.16%) (k=151) were also excluded, leaving a final analytic cohort, k=291 (65.83%).

The statistical analysis of table 1 shows that, in general, among the surveyed people, 396 were males and 46 females. It was observed that amid the male gender, 272 people were declared positive, and 124 declared negative, while 19 females were declared positive, and 27 had not used any illicit drugs. Indeed, the inter-sex comparison indicates that out of 396 male presents, 272 (61.54%) have used illicit drugs, whereas, among the 46 females, 19 (4.30%) have used an illicit drug.

Distribution by sex

At the CRFLD, the studies concerned 442 participants ranging in age from 14 to 35 and above. They were further interrogated if they have knowledge about illicit drugs. All participants were screened before any illicit drugs test, and the results showed that 27.14% (k=120) were healthy. However, the tests revealed that 7.01% (k=31) have some sicknesses that are not linked to any illicit drug disease. Significant correlations (p<0.05) were noted between male and female; male (0.6583 with p=0.0009) are more significant than female (0.4130 with p=0.1254) (Figure 1). Among these participants whom came to the CRFLD, the proportion of male is 89.59% and 10.40% female. The male percentage is much higher than the females (Table 1).

Distribution by age group

The results of illicit drug use among these age groups mainly [14-19], [20-35], and 35 above years old are as follows:

Out of the 167 participants aged from 14 to less than 20, 69 (45.69%) have ever consumed illicit drugs. Furthermore, we compare these results with those obtained for people aged [20-35] with a total of 168 (57.73%) consumers out of 246 individuals (Table 2). Also, a significant correlation was reported at p<0.05 between different age groups [14-19] (0.3367 with p=0.0394), [20-35] (0.5773 with p=0.0076) and [>35] (0.0859 with p=0.0769). This study shows that [20-35] (p=0.0076) are more significant than [14-19] (p=0.0394). In another development, the age group [>35] (p=0.0769) were non-significant. The results are presented in Figure 2.

Distribution by illicit drug consumption

Figure 3 shows that among mono-consumers (mono-cons), the most consumed illicit drug is Tetramethyl cannabinoid (THC) (k = 68) in the three age categories. The study also indicates that THC consumption is

dominated by the age between 20-35 years (23%). In addition to THC, Benzodiazepines (BZO) is the second most used illicit drug (k = 4) and is also dominated by the age group between 20-35 years (1.37%). Finally, we found that the Phencyclidine (PCP) represents the least consumed illicit drug (k = 1), i.e., 0.34%, with the consumer being in the age group of 14-19 years.

Besides the mono-consumers, the analysis of the consumption of various illicit products indicated that some participants had combined two or more substances (drug abuse). For those who combined two substances, the investigation showed that the most commonly combined illicit drugs were THC and BZO (THC-BZO) in all the investigated three age groups (Figure 4). This study also demonstrated that the age between 20-35 years was the most affected by the use of THC-BZO (k = 30), followed by THC-Morphine (MOR) (k = 29), MOR-BZO (k = 7), and THC- Cocaine (COC) (k =5). In the same line of analysis, when considering the people who combined more than two illicit substances (THC-COC) and MOR (THC-COC-MOR) were the most combined products with 13.40% (k = 39) of the poly-consumers. The more striking observation was that the age range between 20-35 years represented the quasi-totality (k = 36) of this combination's consumers. Moreover, the association of THC, COC, MOR, and BZO (THC-COC-MOR-BZO) comes in the second position as the most combined illicit drugs (k = 19). The age range between 20-35 years was always the most affected (Figure 4). Though other combinations were observed, such as THC, BZO, and MOR (THC-BZO-MOR), their use was less among the investigated people (k = 6).

Correlation between illicit drugs and their effects

In the CRFLD, the surveyed people have whether used only one type of illicit drug (cocaine or heroin, cannabis, etc.), while others have consumed multiple illicit substances depending on their availability or the circumstances. In this study, the participants who have consumed one type of illicit drug are characterized as mono-consumers, while those who used more than two substances are called poly-consumers. Comparing the two types of consumers, it can be seen that, on the 291 registered consumers out of all the investigated people, i.e., 65.83%, 149 (51.20%) are mono-consumers, and the others 142 (48.79%) were poly-consumers. Since illicit drugs were often associated with certain behavioral disorders, we found it necessary to evaluate the relation between the consumed substances and their effects (Figure 5).

Indeed, the analysis of patient behaviors shows a set of anomalies that occur alone or in combination. These behavioral disorders were mainly hallucinations (Hall), agitation (Agit), aggressiveness (Aggress), and delirium (Del). Thus, the results present 180 cases of hallucinations (i.e., 61.85%) among the consumers, 28 cases of agitation (5.50%), 23 cases of aggression (5.15%), and 2 cases of delirium (0.69%) concerning the anomalies that occur alone (Figure 5). Combined behavioral disorders were also observed and concern 10 cases of hallucination and agitation (Hall-Agit) (3.44%), 10 cases of hallucination and aggression (3.44%), and 4 cases of agitation and aggression (1.37%). The details mentioned above show that the behavioral disorders were due to the use of some type of illicit drugs.
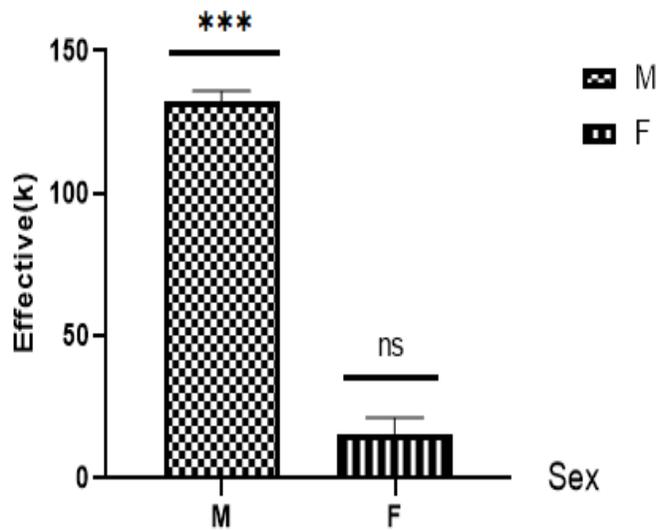
Figure 1: Illicit drug consumption by sex group.
Considered very significant if p <0.001 (***) and (ns): non-significant. male (p=0.0009), female (p=0.1254); P < 0.001 (***) indicating there are means significant different between 2 sex groups. Male are very significant than female.

Table 1: General population surveyed in CRFLD.

Overall (K=442)				Males (K=396)				Females (K=46)			
Cons		Non-Cons		Cons		Non-cons		Cons		Non-Cons	
k	%	k	%	k	%	k	%	k	%	k	%
291	65.83	251	34.16	272	93.47	124	4.26	19	6.52	27	9.27

Cons: Consumers; Non-Cons: Non-Consumers; CRFLD: Centre Régional de Formation à la Lutte Contre la Drogue (health organization).

Table 2: Prevalence of self-reported past six months use of the illicit drug: Level of information, age group, sex, and drug name of consumers.

Characteristics	% of respondents report used (6 months)		
	k	proportion (%)	P value
Age group cons (yrs)			
[14-19]			0.0394*
Mono-cons	65	22.33	
Poly-cons	33	11.34	
[20-35]			0.0076**
Mono-cons	72	24.74	
Poly-cons	96	32.98	

[> 35]			$0.0769^{(ns)}$
Mono-cons	12	4.12	
Poly-cons	13	4.46	
Sex			
Males			0.0009^{***}
Mono-cons	137	91.94	
Poly-cons	135	95.07	
Females			$0.1254^{(ns)}$
Mon-cons	12	8.05	
Poly-cons	7	4.92	
Illicit drug name			
METH	7	2.02	0.0198^{*}
BZO	70	24.05	0.0198^{*}
THC	268	92.09	0.0140^{*}
MOR	102	35.05	$0.0551^{(ns)}$
AMP	1	0.34	$0.4226^{(ns)}$
COC	69	23.71	0.0166^{*}
PCP	2	0.69	$0.1835^{(ns)}$

Values are considered low significant if $0.01 \leq p < 0.05$ (*), significant if $0.001 \leq p < 0.01$ (**), very significant if $p < 0.001$ (***) and (ns): non-significant.
mono-cons proportion: 51.20%, poly-cons proportion: 48.79%. male proportion: 93.47%, female proportion: 6.52%
mono-cons: mono-consumers; poly-cons: poly-consumers; METH: Methamphetamine, BZO: Benzodiazepines; PCP: Phencyclidine; THC: Tetramethyl cannabinoid or marijuana; MOR: Morphine; AMP: Amphetamine; COC: Cocaine.
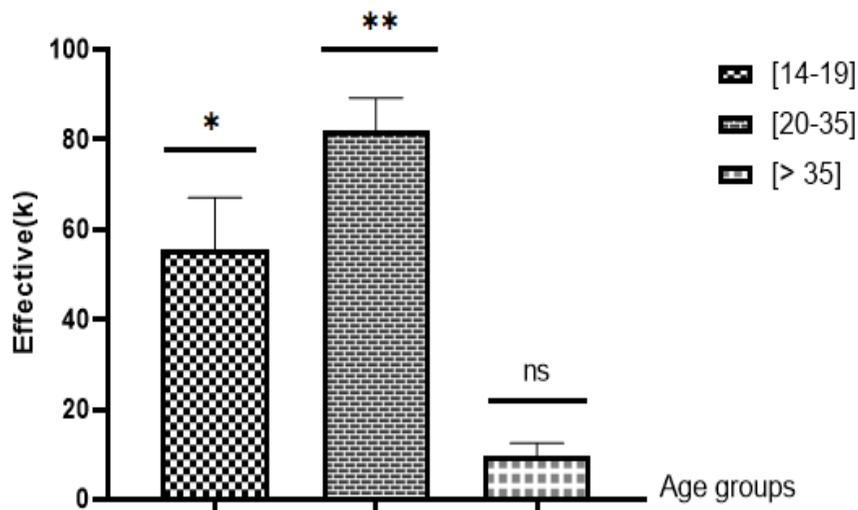

Figure 2: Distribution of illicit drug consumption by age group.
Considered low significant if $0.01 \leq p < 0.05$ (*), significant if $0.001 \leq p < 0.01$ (**), and (ns): non-significant. Among the different age group, P value [14-19]: (*); P value [20-35] :(**), P value [> 35]: (ns); $P < 0.05$ (**) indicating there are means significant different between 3 age groups.
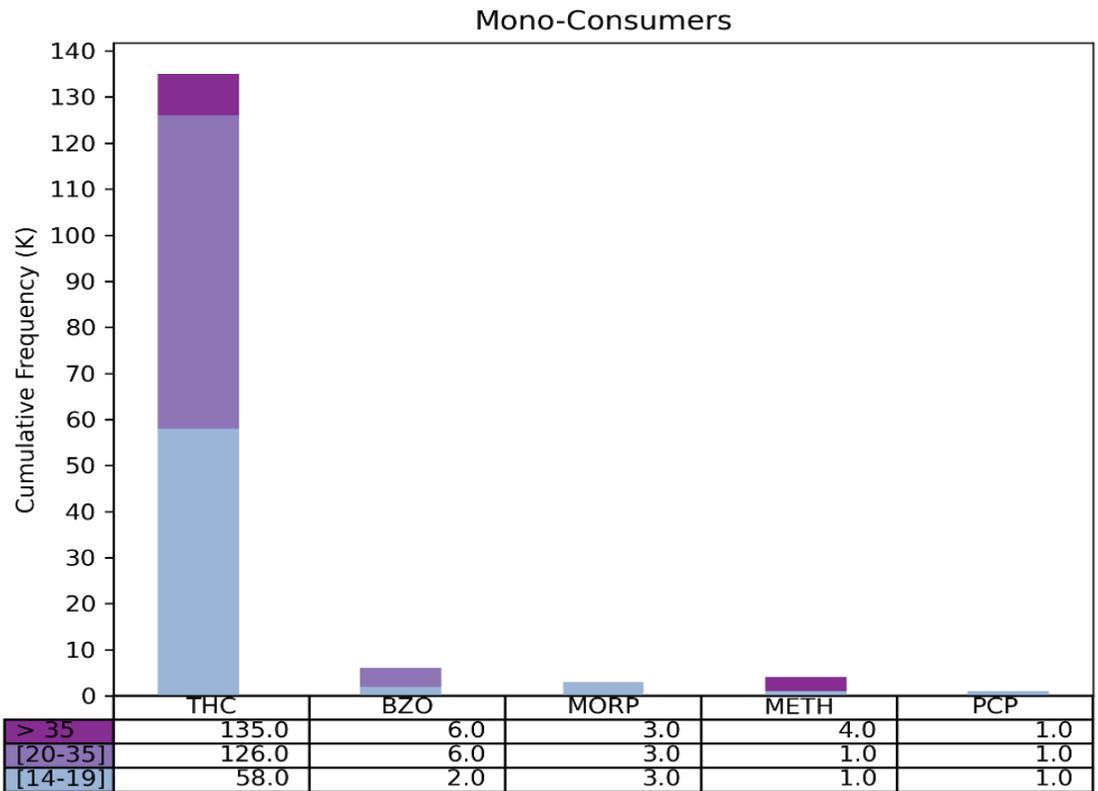
Mono-Consumers

	THC	BZO	MORP	METH	PCP
> 35	135.0	6.0	3.0	4.0	1.0
[20-35]	126.0	6.0	3.0	1.0	1.0
[14-19]	58.0	2.0	3.0	1.0	1.0

Figure 3: Mono-consumers and illicit drug types in a different age category.

Poly-Consumers

	THC-MORP	THC-COC	THC-BZO	MORP-BZO	THC-COC-MORP	THC-BZO-MORP	THC-COC-MORP-BZO	Other
> 35	29.0	5.0	30.0	7.0	39.0	6.0	19.0	7.0
[20-35]	29.0	5.0	25.0	4.0	36.0	6.0	15.0	6.0
[14-19]	10.0	2.0	11.0	0.0	5.0	2.0	1.0	2.0
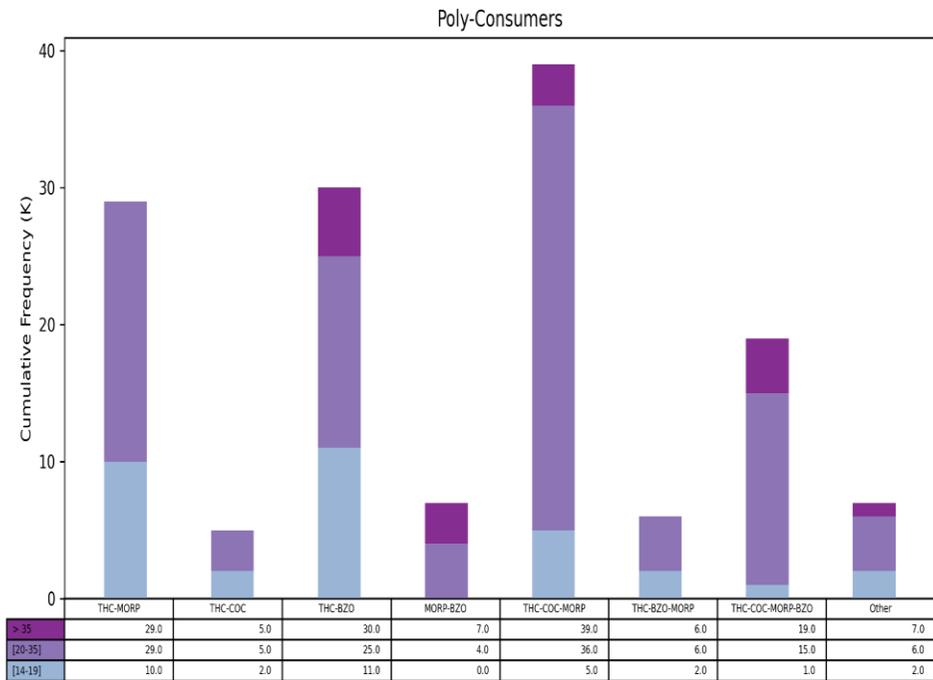
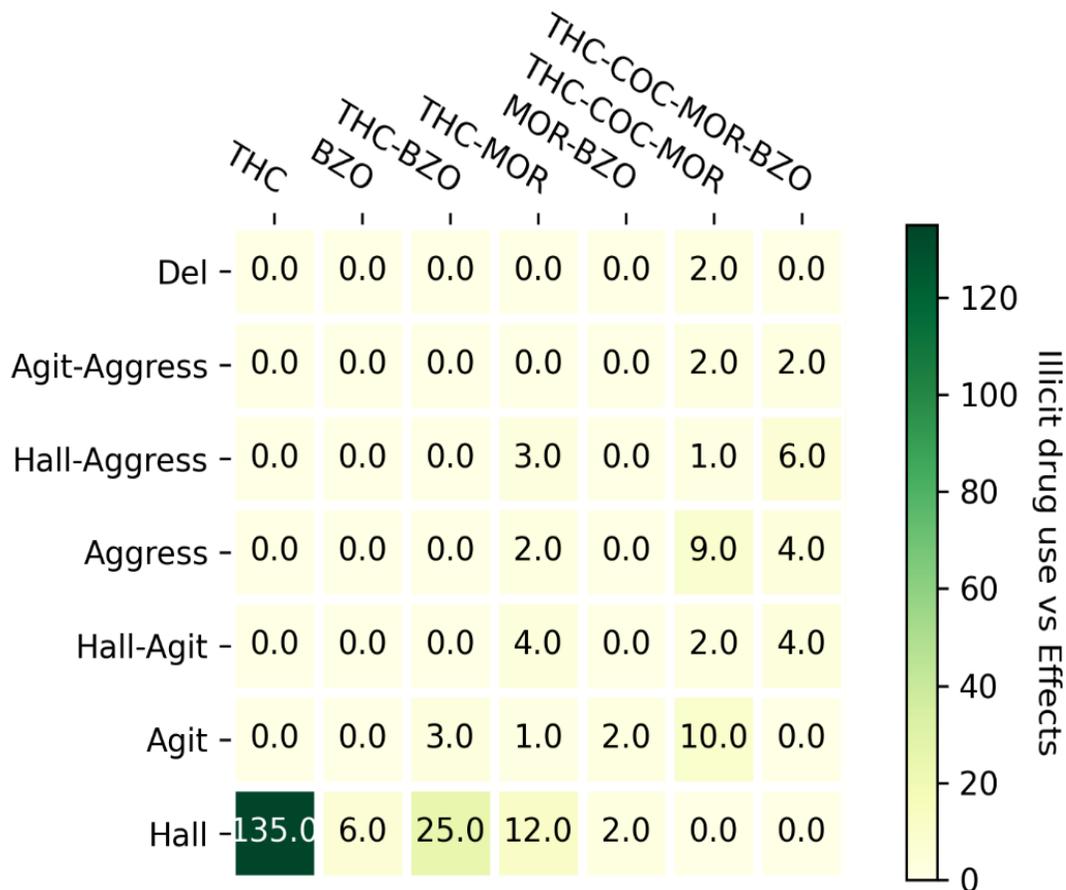**Figure 4:** Poly-consumers and illicit drug types in a different age category.

Figure 5: Correlation between the used illicit drugs and their effects. The scale of graduation of colors rang from light to dark, i.e. from less consumed to more consumed.

DISCUSSION

This study, the results indicate that general illicit drug consumption was 65.84%, and the proportion of the male consumption was 93.47%, which was more than that of female (6.52%). This result falls in line with those of previous studies showing that the prevalence of illicit drug use was significantly (P<0.05) in the male. All the results evidenced that male consume more illicit drug substances than the Females. Prior investigations of the use of illicit drugs in Abidjan carried out by Ouattara et al. (2018) based on an epidemiological survey of illicit substances

showed that females consumed less than males, which implies that our results are consistent. By correlating the use of illicit drugs and the behavioral effects and disorders, this study found that hallucination (61.85%), the most common effect observed among the mono-consumers. It is mostly induced by the utilization of tetrahydrocannabinol (THC), known as cannabis, that the consumption seems to increase among the participants age between 20 to 35 years.

Moreover, the hallucination is provoked by the combination of tetrahydrocannabinol and benzodiazepines (THC-BZO) with 8.59%

and tetrahydrocannabinol and morphine (THC-MOR) with 4.12%. In contrast, agitation, aggressiveness, and delirium behavioral effects and disorders are more associated with the poly consumer. In fact, the agitation is mainly related to the consumption of THC-COC-MOR, while the presence of hallucination and agitation is principally due to the utilization of THC-MOR and THC-COC-MOR-BZO. The aggressiveness combined with hallucination and agitation are induced by the combination of several illicit products (THC-COC-MOR-BZO). Concerning the delirium effect, it was caused principally by the use of THC-COC-MOR (Figure 5). These results are similar to those of Lanctot et al. (2003) and are moreover consistent with trends reported by Braithwaite et al. (2013). Significant and diversified consumption of illicit psychotropic drugs would increase the likelihood of violence. Indeed, in 2004, Statistical study of young Canadian reveals that one of the biggest challenges for young people who use several illegal drugs is their aggressive behavior or other marginal behaviors (Hotton et al., 2004). This same source reports on that criminological studies have confirmed, several occasions, the existence of a correlation between addictive forms and crimes (Ezzati et al., 2002). Furthermore, Ezzati et al. (2002) study a distinction between results that vary by illicit drug type, individual characteristics, socio-demographic structure, economic status, and other environmental influences.

Similarly, Boudreault et al. reported that young men are likely to be sensitive to illicit drugs' adverse effects (Boudreault-Bouchard et al., 2013). They would have more difficulty in controlling the intensity of sensations received by illicit drug-induced changes. Additionally, the consumption of illegal substances among school children harms school results (Ouattara

et al., 2018). Stress, job loss, loneliness, and melancholy can increase the overuse of illicit drugs and relapses of illicit drug abuse (Li et al., 2008). However, previous studies by researchers (Chatterji et al., 2006; Duarte et al., 2006) suggest that illicit drugs create unemployment among the young people. The same results have been described by Van de Bree et al. (2009), as well as the works of McCaggrey et al. (2010) and Clark et al. (2015). The illicit drugs have adverse effects on the individual's mental and physical health of those who consume them (Van et al., 2012; Van et al., 2013), according to our study, some young people or others were engaged in unpleasant practices such as illicit drug use. Indeed, different illicit drugs are prized by these young people, many of whom are hardly teenagers. These young people can obtain narcotics from black markets in their respective area or from big cities at a lower cost or even between 100 and 500 fr CFA in Côte d'Ivoire and US Dollars equivalent of 0.17 to 0.85 for certain drugs. This is the case of THC considered as the most benign of illicit drugs by excellence because of its easiness to get and low price. This illicit substance can cause neurological disorders in the brain, such as dependence. Like the THC, PCP, which are also easy to access at low cost, has several side effects such as weight loss, difficulties with speech and learning, loss of coordination, memory, cognition issues and severe heart complications (Morentin et al., 2019). Afterward, it can also lead to suicide for the user in the long term, amnesia, and other seizures. Besides the THC, benzodiazepines appeared as the second most used illicit drug among the surveyed people. BZO is considered brain nerve agents, minor tranquilizers and affects the user in the short term with side effects such as impaired cognition, lethargy,

depression, impaired vision, impaired motor function, tremors, and nausea and abdominal pain. Long-term use of BZO can cause brain damage and withdrawal symptoms, including body pain, muscle stiffness, sleep disturbances, anxiety, seizures, irritability, and memory problems. According to the National Institute on Drug Abuse in 2013-2017 in the United States (Scholl et al., 2018), it was reported that many deaths were due to benzodiazepine overdoses and others opioid (Wilson et al., 2020). In our investigation, we found that most people claimed to have started with amphetamines, then pursue the use of cannabis. Always looking for a thrill, illicit drug addicts will touch other illicit substances such as opiates, heroin, and cocaine.

Furthermore, we discovered another frequently used form of the illegal product among the secondary school student in Côte d'Ivoire, commonly known as crack and was not included in our study (results do not show in this study). Kalayasiri et al. (2019) have shown that chronic use of certain substances such as methamphetamine leads to dopaminergic neurotoxicity. This hypothesis has been supported by Farhadian et al. (2017), Hart et al. (2012), Tomasi et al. (2013), and those affected have cognitive control deficits. However, this was contradicted by Farhadian et al. (2017) and Hart et al. (2012). All these studies try to give the advantages and inconvenience of abusive consumption. Still, it is necessary that emphasizing the harmful effect is more important and not negligible, especially at an early age (Hall et al., 2015; Van et al., 2015).

Conclusion

This research work finding show that people aged 20-35 years, male were mostly affected among residents in Grand-Bassam (Côte d'Ivoire). Our finding report that THC was the most commonly abused drugs. The correlation between illicit substances and behavioral disorders indicates that hallucinations are the most common effects accompanying the use of illicit drugs among young people, and it is mostly induced by the consumption of tetrahydrocannabinol. We furthermore, our finding suggests that although with a low consumption rate, the use of morphine is highly associated with aggressiveness, and while combining with other products such as tetrahydrocannabinol, cannabis induce some cases of delirium. The effects of illicit drugs harm the individual's systems both physically and psychologically and ruin his personal and family life.

REFERENCES

Berk LE. 2006. *Child Development* (7th edn). Allyn and Bacon: Boston.

Boudreault-Bouchard AM, Dion J, Vandermeersch J, Laberge L, Perron M.

2013. Impact of parental emotional support and coercive control on adolescents' self-esteem and psychological distress: Results of a four-year longitudinal study. *J. Adolesc.,* **4**(36): 695-704. DOI: https://doi.org/101016/j.adolescence.201 3.05.002.

Braithwaite JJ, Broglia E, Bagshaw AP, Wilkins AJ. 2013.Evidence for elevated cortical hyperexcitability and its association with out-of-body experiences in the non-clinical population: new findings from a pattern-glare task. *Cortex.,* **49**(3): 793-805. DOI: https://doi.org/10.1016/j.cortex.2011.11. 013.

Chatterji P. 2006. Illicit drug use and educational attainment. *Health Econ.,* **15**(5): 489-511. DOI: https://doi.org/10.1002/hec.1085

Clark CDA, Kassenboehmer SC, Le T, McVicar D, Zhang R. 2015. 'High'-School: The Relationship between Early Marijuana Use and Educational Outcomes. *Economic Record.,* **91**(293): 247-266. DOI: https://doi.org/10.1111/147-4932.12166

Darke S, Degenhardt L, Mattick R. 2006. *Mortality Amongst Illicit Drug Users: Epidemiology, Causes and Intervention*. Cambridge University Press: Cambridge; 20-41. DOI: https://doi:10.1017/CBO9780511543692 .003

Degenhardt L, Chiu WT, Sampson N, Kessler RC, Anthony JC, Angermeyer M, Bruffaerts R, Girolamo G, Gureje O, Huang Y, Karam A, Kostyuchenko S, Lepine JP, Mora MME, Neumark Y, Ormel JH, Meza AP, Villa JP, Stein DJ, Takeshima T, Wells JE. 2008. Toward a global view of alcohol, tobacco, cannabis, and cocaine use: Findings from the who world mental health surveys. *PLoS Medicine,* **5**(7): e141-e141. DOI: https://doi.org/10.1371/journal.pumed.00 50141.

Duarte R, Escario JJ, Molina JA. 2006. Marijuana consumption and school failure among Spanish students. *Econ Educ Rev.,* **25**(5): 472-481. DOI: https://doi.org/101016/j.econedurev.2005 .05.004

Eaton DK, Kann L, Kinchen S, Ross J, Hawkins J, Harris WA, Lowry R, McManus T, Chyen D, Shanklin S, Lim C, Grunbaum JA, Wechsler H. 2006. Youth risk behavior surveillance-United States, 2005. *MMWR Surveill Summ.,* **55**(5):1-108.

Ezzati M, Lopez AD, Rodgers A, Hoorn SV, Murray JCL. 2002. Selected major risk factors and global and regional burden of disease. *The Lancet,* **360** (9343): 1347-1360. DOI: https://doi.org/10106/S0140-6736(02)11403-6

Farhadian S, Patel P, Spudich S. 2017. Neurological Complications of HIV Infection. *Curr Infect Dis Rep.,* **19**(12): 50. DOI: https://doi.org/10.1007/s11908-017-0606-5.

Fineberg NA, Haddad PM, Carpenter L, Gannon B, Sharpe R, Young AH, Joyce E, Rowe J, Wellsted D, Nutt DJ, Sahakian BJ. 2013. The size, burden and cost of disorders of the brain in the uk. *J Psychopharmacol.,* **27**(9): 761-770. DOI: https://doi.org/10.1177/02698811134951 18.

Hall W. 2015. What has research over the past two decades revealed about the adverse health effects of recreational cannabis use? *Addiction,* **110**(1): 19-35. DOI:

https://doi.org/10.1111/add.12703.

Hart HLA, Hart HLA, Green L. 2012. *The Concept of Law* (3rd edn). Oxford University Press: Oxford.

Hotton T, Haans D. 2004. Alcohol and drug use in early adolescence-Statistics Canada. *Heath reports.,* **15**: 67.

Jernigan JA, Stephens DS, Ashford DA, Omenaca C, Topiel MS, Galbraith M, Tapper M, Fisk TL, Fridkin SK, Sejvar JJ, McConnell M, Guarner J, Shieh WJ, Malecki JM, Gerberding JL, Hughes JM, Perkins BA. 2001. Bioterrorism-related inhalational anthrax: The first 10 cases reported in the united states. *Emerging Infectious Diseases,* **7**(6): 933-944. DOI: https://doi.org/10.3201.eid0706.010604.

Kalayasiri R, Kraijak K, Mutirangura A, Maes M. 2019. Paranoid schizophrenia and methamphetamine-induced paranoia are both characterized by a similar LINE-1 partial methylation profile, which is more pronounced in paranoid schizophrenia. *Schizophr Res.,* **208**: 221-227. DOI: https://doi.org/10.11016/j.schres.2019.02.015

Kavanagh M, Walker J. 2013. Assessing and managing patients with cauda equina syndrome. *Br J Nurs.,* **22**(3): 134-137. DOI: https://doi.org/10.12968/bjon.2013.22.3.134

Lanctot KL, Herrmann N, Yau KK, Khan LR, Liu BA, LouLou MM, Einarson TR. 2003. Efficacy and safety of cholinesterase inhibitors in alzheimer's disease: A meta-analysis. *CMAJ.,* **169**(6): 557-564.

Li CSR, Yan P, Sinha R, Lee TW. 2008. Subcortical processes of motor response inhibition during a stop signal task. *Neurolmage,* **41**(4): 1352-1363. DOI:

https://doi.org/10.1016/j.neuroimage.2008.04.023.

McCaffrey DF, Pacula RL, Han B, Ellickson P. 2010. Marijuana use and high school dropout: the influence of unobservables. *Health Con.,* **19**(11): 1281-99. DOI: https://doi.org/10.1002/hec.1561

Morentin B, Callado LF. 2019. Sudden cardiac death associated to substances of abuse and psychotropic drugs consumed by young people: A population study based on forensic autopsies. *Drug and Dependence,* **201**: 23-28. DOI: https://doi.org/10.1016/j.drugalcdep.2019.03.021

Ouattara N, Yao KM, Doubran PJD, Tako AN, Sery B. 2018. Epidemiology of drug consumption among young aged 9-22 Years at schools in Abidjan (Ivory Coast). *IJISR.,* **38**(2): 212-219.

Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. 2018. Drug and Opioid-Involved Overdose Deaths - United States, 2013-2017. *MMWR Morb Mortal Wkly Rep.,* **67**(5152): 1419-1427. DOI: https://doi.org/10.15585/mmwr.mm675152e1

Tomasi D, Volkow ND. 2013. Striatocortical pathway dysfunction in addiction and obesity: differences and similarities. *Critical Reviews in J Biochem. Mol. Bio.,* **48**(1): 1-19. DOI: https://doi.org/10.3109/10409238.2012.735642.

Van den Bree MBM, Shelton K, Bonner A, Moss S, Thomas H, Taylor PJ. 2009. A longitudinal population-based study of factors in adolescence predicting homelessness in young adulthood. *J. Adolesc Health.,* **45**(6): 571-578. DOI: https://doi.org/101016/j.jadohealth.2009.03.027

Van OJC, Williams J. 2012. The effects of cannabis use on physical and mental health. *Health Econ.,* **31**(4): 564-577. DOI: https://doi.org/101016/j.jhealeco.2012.04 .003.

Van OJC, Jan C, Jenny W, Fergusson D, Horwood LJ. 2013. Cannabis use and suicidal ideation. *J Health Econ.,* **32**(3): 524-537. DOI: https://doi.org/101016/j.jhealeco.2013.04 .002.

Wilson N, Kariisa M, Seth P, Smith H, Davis NL. 2020. Drug and opioid-involved overdose deaths-united states, 2017-2018. *MMWR Morb Mortal Wkly Rep.,* **69**(11): 290-297. DOI: https://doi.org/10.15585/mmwr.mm6911 a4.

Windle M, Spear LP, Fuligni AJ, Angold A, Brown JD, Smith GT, Giedd J, Dahl RE. 2008. Transitions into underage and problem drinking: Development processes and mechanisms between 10 and 15 years of age. *Pediatrics,* **121**(4): S273-S289. DOI: https://doi.org/10.1542/peds.2007-2243C.