ISSN 2220-3206 (online)

World Journal of *Psychiatry*

World J Psychiatry 2022 October 19; 12(10): 1268-1312

Published by Baishideng Publishing Group Inc

WJP World Journal of Psychiatry

Contents

Monthly Volume 12 Number 10 October 19, 2022

REVIEW

MINIREVIEWS

ORIGINAL ARTICLE

Observational Study

World Journal of Psychiatry

Monthly Volume 12 Number 10 October 19, 2022

Contents

ABOUT COVER

Editorial Board Member of *World Journal of Psychiatry*, Xin-Qiao Liu, PhD, Associate Professor, School of Education, Tianjin University, Tianjin 300350, China. xinqiaoliu@pku.edu.cn

AIMS AND SCOPE

The primary aim of *World Journal of Psychiatry* (*WJP*, *World J Psychiatry*) is to provide scholars and readers from various fields of psychiatry with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJP mainly publishes articles reporting research results and findings obtained in the field of psychiatry and covering a wide range of topics including adolescent psychiatry, biological psychiatry, child psychiatry, community psychiatry, ethnopsychology, psychoanalysis, psychosomatic medicine, *etc.*

INDEXING/ABSTRACTING

The *WJP* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Current Contents/Clinical Medicine, Journal Citation Reports/Science Edition, PubMed, PubMed Central, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2022 Edition of Journal Citation Reports® cites the 2021 impact factor (IF) for *WJP* as 3.500; IF without journal self cites: 3.313; 5-year IF: 7.380; Journal Citation Indicator: 0.62; Ranking: 89 among 155 journals in psychiatry; and Quartile category: Q3.

RESPONSIBLE EDITORS FOR THIS ISSUE

NAME OF JOURNAL
World Journal of Psychiatry

ISSN
ISSN 2220-3206 (online)

LAUNCH DATE
December 31, 2011

FREQUENCY
Monthly

EDITORS-IN-CHIEF
Rajesh R Tampi, Ting-Shao Zhu, Panteleimon Giannakopoulos

EDITORIAL BOARD MEMBERS
https://www.wjgnet.com/2220-3206/editorialboard.htm

PUBLICATION DATE
October 19, 2022

INSTRUCTIONS TO AUTHORS
https://www.wjgnet.com/bpg/gerinfo/204

GUIDELINES FOR ETHICS DOCUMENTS
https://www.wjgnet.com/bpg/GerInfo/287

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH
https://www.wjgnet.com/bpg/gerinfo/240

PUBLICATION ETHICS
https://www.wjgnet.com/bpg/GerInfo/288

PUBLICATION MISCONDUCT
https://www.wjgnet.com/bpg/gerinfo/208

ARTICLE PROCESSING CHARGE
https://www.wjgnet.com/bpg/gerinfo/242

STEPS FOR SUBMITTING MANUSCRIPTS
https://www.wjgnet.com/bpg/GerInfo/239

ONLINE SUBMISSION
https://www.f6publishing.com

World Journal of Psychiatry

Submit a Manuscript: https://www.f6publishing.com

World J Psychiatry 2022 October 19; 12(10): 1268-1286

DOI: 10.5498/wjp.v12.i10.1268

ISSN 2220-3206 (online)

REVIEW

Substance use and substance use disorders in Africa: An epidemiological approach to the review of existing literature

Olakunle James Onaolapo, Anthony Tope Olofinnade, Foluso Olamide Ojo, Olufunto Adeleye, Joshua Falade, Adejoke Yetunde Onaolapo

Specialty type: Psychiatry

Provenance and peer review: Invited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0
Grade B (Very good): B, B, B
Grade C (Good): C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Kar SK, India; Liu XQ, China; Setiawati Y, Indonesia

Received: March 4, 2022
Peer-review started: March 4, 2022
First decision: April 18, 2022
Revised: May 1, 2022
Accepted: September 7, 2022
Article in press: September 7, 2022
Published online: October 19, 2022

Olakunle James Onaolapo, Behavioral Neuroscience Unit, Neuropharmacology Subdivision, Department of Pharmacology, Ladoke Akintola University of Technology, Ogbomoso 210214 Oyo, Nigeria

Anthony Tope Olofinnade, Department of Pharmacology, Therapeutics and Toxicology, Lagos State University, Ikeja 100001, Lagos, Nigeria

Foluso Olamide Ojo, Olufunto Adeleye, Department of Anatomy, Ladoke Akintola University of Technology, Ogbomoso 210214, Oyo, Nigeria

Joshua Falade, Department of Mental Health, Afe Babalola University, Ado-Ekiti 360282, Ekiti, Nigeria

Adejoke Yetunde Onaolapo, Behavioral Neuroscience Unit, Neurobiology Subdivision, Department of Anatomy, Ladoke Akintola University of Technology, Ogbomoso 210214, Oyo, Nigeria

Corresponding author: Adejoke Yetunde Onaolapo, MBBS, MSc, PhD, Reader (Associate Professor), Behavioral Neuroscience Unit, Neurobiology Subdivision, Department of Anatomy, Ladoke Akintola University of Technology, Old Oyo/Ilorin Road Ogbomoso P.M.B 4000, Ogbomoso 210214, Oyo, Nigeria. adegbayibiy@yahoo.com

Abstract

The relationship between man and substances that have abuse potentials, and whose use has been associated with the development or progression of substance use disorders has continued to evolve in terms of geography, economic implications, and time. History shows that local plants with psychoactive constituents can get exported worldwide through global travel, commerce, or even conquest. Time and globalization also change people's relationship with substances of abuse; hence, an area that was initially alien to certain substances might evolve to becoming a trafficking hub, and then a destination. A case in point is Africa where a rapidly increasing prevalence of substance use/abuse and substance use disorder among adolescents and young adults is putting enormous strain on the economy, healthcare system, and society at large. However, there appears to be a paucity of scientific literature and data on the epidemiology, risk assessment, and contributing factors to substance use and the development of substance use disorders across Africa. In this narrative review, we examine extant literature (PubMed, Google scholar, Medline) for information on the prevalence, trends, and

influencers of substance use and the development of substance use disorders. This is with a view of understanding the determinants of substance use and factors that influence the development of substance use disorders in the region, and how this information can be channeled towards developing a comprehensive intervention and treatment program.

Key Words: Addiction; Cannabis; Catha edulis; Datura metal; Drug dependence; Novel psychoactive substances

Core Tip: Substance use for medicinal and recreational purposes dates back centuries; however, in recent times, substance use is increasingly becoming a global public health crisis. In Africa, there is a consensus that substance use is emerging as a public health crise, but there appears to be a paucity of data on the epidemiology, risk assessment, and contributing factors to substance use and the development of substance use disorders across Africa. Here, we examined the extant literature for information on the prevalence, trends, and influencers of substance use and substance use disorders as it relates to Africa.

Citation: Onaolapo OJ, Olofinnade AT, Ojo FO, Adeleye O, Falade J, Onaolapo AY. Substance use and substance use disorders in Africa: An epidemiological approach to the review of existing literature. *World J Psychiatry* 2022; 12(10): 1268-1286
URL: https://www.wjgnet.com/2220-3206/full/v12/i10/1268.htm
DOI: https://dx.doi.org/10.5498/wjp.v12.i10.1268

INTRODUCTION

Substance use and substance use disorders are increasingly becoming a global public health crisis, largely due to their increasing prevalence, worsening disability-adjusted life years, and high socioeconomic burden[1]. According to the World Drug Report, 2021[2], approximately 275 million people used drugs worldwide in the preceding year, with another 36 million persons diagnosed with substance use disorders globally[2]. In 2019 alone, substance use disorders were linked to about 18 million years of healthy life lost. Also, about 180000 deaths were directly linked to substance use disorders, while another half million deaths were attributed to illicit drug use[3].

Substance use is generally defined as a patterned use of any substance (including alcohol and/or psychoactive drugs) in quantities (or through methods) that are harmful to the user or others[4]. Substance use is often associated with varying degrees of intoxication, which is associated with alteration of judgment, attention, and perception. The use of alcohol, illicit drugs, and illegal use of prescription medications has been associated with negative impact on the individual's health and productivity, as well as a high socioeconomic burden on the family and society[5,6]. Globally, there is a rapidly rising prevalence of substance use and substance use disorders, with an associated increase in the morbidity and mortality. Also, in Africa, the use of illicit substances such as cannabis (the most widely used substance in Africa, with a prevalence of between 5.2% and 13.5% in West and Central Africa), amphetamine-type stimulants, and benzodiazepines is increasing rapidly[7]. Again, in the last decade, Africa has begun to be recognized as a consumer and a destination for illicit drugs, compared to being previously regarded as mainly a transit zone for these drugs (serving as a link between Latin America and Europe)[8,9]. This reversal of the illicit drug trend is believed to be a contributing factor to the rapid development of substance use epidemic, particularly in the urban centers of Africa.

There is a consensus that substance use (particularly among adolescents and young adults) in Africa is emerging as a public health crises; however, there appears to be a paucity of scientific literature and data on the epidemiology, risk assessment, and contributing factors to substance use and the development of substance use disorders across Africa. Here, we reviewed the extant literature for information on the prevalence, trends, and influencers of substance use and the development of substance use disorders. This is with a view of understanding the determinants of substance use and the factors that influence the development of substance use disorders in the region, and how this information can be channeled towards developing a comprehensive interventions and treatment program.

History of substance use and substance use disorders

Substance use for medicinal, religious, and recreational purposes dates back centuries. The earliest mentions of the use of alcoholic or fermented beverages in Chinese writing dates far back as the 7th

millennia B.C.E[10], although there is also evidence from Sumerian writing (2100 B.C.E) of the use of opium from the poppy plant[11]. While the earliest use had been linked mainly to medicinal and religious purposes[10-12], there are also documentations of their use for recreational purposes[12]. However, since ancient times, humans have recognized the health problems that may be associated with excess alcohol consumption[12-14].

In 2019, the United Nations Office on Drugs and Crime reported an estimated 35 million people having a substance use disorder necessitating treatment[15]. Surveys and results of prospective studies examining patterns of drug use among the general population has revealed substance use peaks between 18 years and 25 years of age[15,16] with drug use among young people exceeding that of older people[15,17].

History of substance use in Africa: From transit nations to major illicit drug destinations

The African continent has a long history of drug cultivation, production, trade and consumption; and there are also indigenous plants and herbs with psychoactive effects such as cannabis resin (known as hashish in North Africa), Catha edulis (known as Kath in East Africa), and cannabis (known as dagga in Southern Africa) that have also been used traditionally for centuries[18-21]. In the last few years, rapidly growing large-scale trade and recreational use of opiates, synthetic psychoactive stimulants, and prescription drugs are emerging threats in the African continent[21].

The relationship between North Africa and cannabis has existed for centuries, predating the arrival of the Spanish and French in the 19th century. Also, during the colonial era, cannabis was cultivated in small quantities across the northern Rif mountains in Morocco, and throughout the northern parts of Tunisia and Algeria[22]. While production was mainly to meet local demands (with some smuggling and exportation to Europe), the era following independence of the different countries in the region saw regulations and laws being enacted and enforced to control the production, sale, and use of cannabis. However, across the four countries (Morocco, Algeria, Tunisia and Libya) that make up the Maghreb (an area also known as northwest Africa), the drug trade has not only continued to grow, it is also evolving. In the last few decades, a region known mainly for the production of cannabis destined for other markets (particularly the European market) has increasingly become an important route for the trafficking of cocaine and different psychotropic pills. Since the beginning of the 21st century, trafficking routes for cocaine, cannabis resin, and psychotropic pills that existed between South America, Africa, and Europe shifted to transect the Maghreb region[22]. This change has been partly attributed to an increase in the demand for drugs in the region, and the perturbations of other transit zones such as the Sahel region, which has become unstable. Most important is the geographic location of the region, being a link between Africa, Middle East and Europe. While drug transit routes through North Africa is increasing, of more importance is the increasing rate of consumption of these drugs in the region. The use of psychotropic drugs, which are very addictive, is nearing epidemic proportions in the region; also, other substances being consumed include cannabis, cocaine and opioids[22].

Before West Africa began to be considered a transit zone for drugs, it was also a producer of cannabis products (although not on the scale of the North African countries), which were shipped to Europe and the United States. Although, at the same time, marijuana was being imported into Nigeria from South Africa and a region now known as the Democratic Republic of Congo[23]. The smuggling of heroin through West Africa was first documented in 1952[23]; however, West Africa's rise as a major drug smuggling hub began sometime in the 1960s, coinciding with a period of increased demand for illegal drugs, including marijuana which was grown and exported from Nigeria in large quantities to Europe. Despite attempts by governments in these countries to stem the tide of the marijuana export, marijuana trade continued illegally for several years until the demand for newer psychoactive substances such as cocaine and heroin overtook the demand for marijuana[24]. By the 990th year of the 2nd millennium and the 90th year of the 20th century, West Africa had become a major transit and repackaging center for substances such as cocaine and heroin through a transnational trade route that originated from South America and Asia, to Europe. While drug trafficking through Africa was not new, an intense clamp-down on the South-North American trade routes by the United States anti-narcotics strategies and the increase in demand for drugs across Europe saw to the rapid expansion of the West African trade routes in the early 21st century[25,26]. The geography of the West African states (made up of large areas of uninhabited islands and archipelagoes found in countries like Guinea Bissau) eased transit and made detection difficult[27]. Also, the vulnerable political environment with the presence of civil wars/insurgencies created fertile grounds for the development of criminal networks in the West African sub region [27].

Previously, when compared to West Africa, the drug trafficking routes through the Eastern belt of Africa were less robust; however, in the last few decades of this century, the trend is an increase in the trafficking of and the variety of trafficked drugs through the East African states of Kenya, Uganda, and Tanzania. Specifically, the trafficking of heroin and cocaine through these countries has grown considerably. Trafficking routes begin in Afghanistan where heroin is produced, through Pakistan and then East Africa enroute over Europe. The cocaine transnational trafficking routes began to go through East Africa in a bid to bypass the West African routes that were increasingly being watched by anti-drug trafficking authorities[28]. Also observed was that the increased consumption of these substances coincided with an increase in trafficking and affordability of the drugs.

In South Africa, a country in the southern region of Africa, the trafficking of drugs has increased. There are reports that since the period prior to and following the transition to democracy, there has been an escalation of drug trafficking. Trafficking in these parts has increased as a result of the easing of the strict control of land, air and sea borders, and an increase in international trade that occurred following the reintegration of South Africa into the committee of nations following the end of apartheid. Also, the effective policing of traditional smuggling routes prompting the search for other shipping routes also accounts for the increased trafficking of drugs through South Africa[29]. The increased trafficking is also worsening the substance use problems as a proportion of the drugs trafficked end up on the local market. There have also been reports that drugs such as methaqualone are also produced in clandestine laboratories in the region[30]. Overall, the level of affluence in the region makes it an attractive 'emerging market' for illicit drugs[30-32]. South Africa also has a history of drug use that dates as far back as the 15th century. Cannabis, which is known as dagga in South Africa, has been consumed traditionally for centuries. The cannabis plant was brought to southern Africa by Saheli merchants from eastern Africa and some members of the bantu tribe of central and southern Africa where it has been cultivated since the 15th century. Around the 16th and 18th century, the consumption of cannabis increased significantly[33]. Although initially popular only among the African population, over time, its use extended to the white population of South Africa[30].

Overall, while the current substance use epidemic in the African continent could be linked to the global trend in substance use, the transformation of African nations from mainly transit points in the international drug network to consumer countries would seem inevitable[34]. Also, the rapid socioeconomic changes that have occurred across the different countries that make up the African continent could have facilitated this shift in what can be assumed to be the "normal trend".

EPIDEMIOLOGY OF SUBSTANCE USE ACROSS THE AFRICAN CONTINENT

Across Africa, reports spanning the last two decades show that substance use especially among adolescents and young adults is increasing at alarming rates[19,35-41]. The World Health Organization and the United Nations Office on Drugs and Crime reported, an exponential increase in the per capita consumption of alcohol as well as the cultivation, trade, and consumption of cannabis in most of the countries in Africa, with suggestions that this could inevitably have adverse socioeconomic and public health implications[42-44]. At the time, about 10 countries in Africa were listed among the 22 countries with the highest increases in the use of alcohol and other psychoactive substances including cannabis, tobacco, cocaine, and heroin[45]. In 2013, the United Nations Office on Drugs and Crime World Drug Report estimated that across the African continent, more than 28 million people had a current history of substance use. Cannabis was also reported to be the most commonly used drug on the continent, with the prevalence estimated to be 7.5%, which was almost twice the global average. The use of opioids was also reportedly on the rise[46].

While it has been recognized that Africa is beginning to battle a drug use epidemic, with an estimated 37000 people in Africa dying annually from substance use-associated complications[47-49]; available data for Africa are still either weak or nonexistent. To date, in many African countries, there is still a paucity of national data regarding the epidemiology and patterns of substance use across populations, with available data largely limited to small prospective population studies and retrospective hospital-based studies.

In West Africa, the paucity of data regarding the prevalence of drug use undermines our ability to adequately understand the full extent of the substance use problem, and how it is creating a public health problem that further threatens the already fragile health system that currently exists. It also creates a false sense of safety, because it fosters the erroneous belief that substance use is under control. However, in the last few years, this trend is becoming more difficult to ignore, because there is now increasing evidence from the increase in crime/criminal behaviors and an increasing need for medical attention that arises from the development of substance use disorders or complications of risky behaviors that are consequences of drug use. In the last decade, in West African countries like Ghana, incident reports from health professionals, lawyers, and law enforcement officers are beginning to show dramatic increases in the domestic consumption of illicit drugs. However, these reports do not adequately portray the scale of substance use problem; because there is a dearth of national figures that can accurately quantify the prevalence of drug use in Ghana or most other West African countries. All of these result in a huge dependence on small-scale cross-sectional studies (Table 1). A 2008 population-based study conducted among school-going adolescents, reported that the prevalence of any substance use in the preceding 1 mo was 3.6%[50]. The results of an earlier study that interviewed a sample of 894 high school students with a mean age of 17.4 years, reported that the lifetime alcohol use in these cohort was 25.1%; with cigarette use and lifetime marijuana use being 7.5% and 2.6%, respectively. Also, current alcohol use was reported to be 46.2%; current cigarette and marijuana use was 44.6% and 58.3%, respectively[51]. The result of a 2014 cross-sectional survey of a sample of 227 street children and youths revealed that the current prevalence of alcohol and marijuana use was 12% and 16.2%, respectively. Sex differences in substance use was also reported with more females using alcohol, marijuana, and

Table 1 Epidemiology of substance use across the African continent

Region	Study type	Study group	Result	Ref.
Ghana	Population-based study	School-going adolescents	3.6% prevalence of substance use in the preceding 1 mo	[50]
Ghana	Cross-sectional study	894 high school students with a mean age of 17.4 yr	Lifetime alcohol use was 25.1%; with cigarette use and lifetime marijuana use being 7.5% and 2.6% respectively. Current alcohol use was 46.2%; current cigarette and marijuana use was 44.6%; and 58.3%, respectively	[51]
Ghana	Cross-sectional survey	227 street children and youths	Current prevalence of alcohol and marijuana use was 12% and 16.2%, respectively	[52]
Nigeria	Cross-sectional study Northwestern Nigeria	280 secondary school students	56% of them had a history of substance use (kolanut, cigarettes, and marijuana)	[53]
Nigeria	Cross-sectional study Southwestern Nigeria	249 secondary school students	Prevalence of alcohol and substance use was 21.7% and 26.3%, respectively, tramadol being the substance of choice	[54]
Nigeria	National drug survey	Population-based	Approximately 14.3 million people (accounting for 14.4% of the population aged between 15-64 yr) had a history of current and continuing substance drug use, with close to 3 million having at least a form of drug use disorder	[55]
Ethiopia	Demographic and health survey	Population-based	4% of youths and 6.3% of individuals in age groups of 25-29 yr smoked cigarettes, while 53% of men and 45% of women consumed alcohol	[59]
Ethiopia	Analysis of data extracted from the 2016 Ethiopia Demographic and Health Survey	12688 male cohorts	62.5% (7931 males) had a current history of substance use (alcohol, Kath, or tobacco). Inhabitants of the Amhara, Tigray and Oromia regions had a current substance use prevalence of 18.5%, 14.2% and 12.8%, respectively	[60]
Ethiopia	Cross-sectional study Northeastern Ethiopia	730 university students in	Lifetime prevalence of alcohol consumption, Kath chewing, and cigarette smoking was 33.1%, 13% and 7.9%, respectively, and current prevalence was 27.9%, 10.4% and 6.4%	[61]
Ethiopia	Cross-sectional study	794 university students	73.7% had a history of substance use with the lifetime prevalence of illicit drugs being 23.3%	[63]
Egypt	Hospital-based study (single-center experience)	First episode drug-induced psychosis patients	Substance abuse rates are as high as 10%-20% the global average with cannabis and tramadol being the most abused substance	[65]
Tunisia	Cross-sectional study	298 persons with a history of drug use	Cannabis was the most widely consumed illicit drug, followed by benzodiazepines, buprenorphine, cocaine, and ecstasy	[68]
Tunisia	Mediterranean school survey project	Secondary school students	Tobacco, alcohol, and cannabis were the substances most frequently used	[66, 67]
Tunisia	Epidemiologic/toxicological investigation Northern Tunisia	11170 suspected drug users	A preponderance of males (97.4%), with a median age of 29 ± 7.91 yr. 91.3 % were single	[69]
South Africa	School-based survey	Secondary school students	13% of the students (aged 19 yr and below) had an history of cannabis use, although current use was 9%. 12% had a current use of heroin, 11% used inhalants and 6% consumed mandrax	[73]
South Africa	National household survey	Population-based	Past 3 mo prevalence for cannabis among 15-19-years-old was 3%	[74]

smoking cigarettes compared to males[52]. In Nigeria, reports from small-scale studies have demonstrated a high prevalence of substance use among adolescents and young adults. A 2009 study that examined the prevalence of substance use among 280 students at a senior secondary school in a town in Northwest Nigeria, revealed that about 56% of them had a history of substance use, with the most common being kolanut, cigarettes, and marijuana[53]. Idowu *et al*[54] also examined the prevalence of substance use among 249 students (mean age = 16.3 ± 2 standard deviations) of secondary schools in a metropolis in south western Nigeria and reported that the prevalence of alcohol and substance use was 21.7% and 26.3%, respectively, with tramadol being the substance of choice[54]. The magnitude of the effect was best conveyed by the results of the 2018 National Drug Use Survey which revealed that approximately 14.3 million people (accounting for 14.4% of the population aged between 15 years and 64 years) had a history of current and continuing substance drug use, with close to 3 million having at least a form of drug use disorder[48,55]. A difference was also observed in the prevalence of drug use between the Northern and Southern geopolitical zones, with a higher prevalence in the regions in the south (13.8%-22.4% of the population) compared to those in the northern geopolitical zone (10%-14.9% of the population). In Nigeria, cannabis was the most commonly used drug, which was followed by opioids (non-prescription or in cough syrup)[48,56]. The survey also highlighted

a rise in the current use of psychoactive substances (including cannabis), the non-medical use of prescription drugs such tramadol, codeine, morphine or cough syrups that contain codeine or dextromethorphan[55]. Also observed was an overall high incidence of drug use (excluding alcohol) among males compared to females (10.8 million males *vs* 3.4 million females), although the sex difference in the non-medical use of prescription opioids, cough syrups, and sedatives was not as significant (6% among men compared to 3.3 among women). The survey also reported a higher incidence of drug use among young adults (24-39) compared to those aged 24 and below[55].

In East Africa, there is also a dearth of national statistical data on the prevalence of substance use in a number of the countries, with researchers and policy makers needing to rely on information from studies involving subsets of the populations. In Ethiopia, alcohol, Kath and tobacco are the most popular substances that are consumed[57,58]. A 2012 Ethiopian demographic and health survey reported that 4% of youths and 6.3% of individuals in age groups of 25-29 years smoked cigarettes, whereas 53% of men and 45% of women consumed alcohol[59]. Also, the results of a study by Girma *et al*[60] that analyzed data extracted from the 2016 Ethiopia Demographic and Health Survey revealed that of the 12688 male cohorts of the Ethiopian Demographic and Health Survey, at least 62.5% (7931 males) had a current history of substance use (alcohol, Kath, or tobacco) as at the time of the survey. Inhabitants of the Amhara, Tigray, and Oromia regions have a current substance use prevalence of 18.5%, 14.2%, and 12.8%, respectively. Alcohol (53.1%) is reportedly the most commonly consumed substance, followed closely by Kath, which has a prevalence of 25.9%[60]. Reports of small cross-sectional studies have also corroborated the high prevalence of alcohol, Kath, and cigarette smoking among Ethiopian youths[61]. Adere *et al*[61] examined a cohort of 730 university students in Northeastern Ethiopia and reported that the lifetime prevalence of alcohol consumption, Kath chewing, and cigarette smoking was 33.1%, 13%, and 7.9%, respectively, whereas the current prevalence of these substances is 27.9%, 10.4%, and 6.4%, respectively[61]. The prevalence observed in this study was similar to that observed in an earlier study carried out among the students at a University in a town in North Ethiopia[62]. While earlier studies among university students did not report evidence to suggest the use of illicit drugs, the results of a 2021 cross-sectional study among 794 students of Addis Ababa University, showed that 73.7% of the study participants had a history of substance use with the use of illicit drugs having a lifetime prevalence of 23.3%[63]. However, similar to other studies, alcohol, Kath, and cigarettes were still the most commonly abused substances[63].

In North Africa, data and information on substance use, production, trafficking, and consumption are also limited. This has been attributed to a lack of capacity for data collection and analysis[64]. In Egypt, there are reports that substance abuse rates are as high as 10%-20% the global average, with cannabis and tramadol being the most abused substances[65]. In Tunisia, an increase in the trafficking and consumption of psychoactive substances have been observed since the political uprising that occurred in 2011[66]. There have also been reports of increased availability of drugs of abuse, particularly to school students[66]. These increases have been confirmed by a few epidemiological studies[66-68]. Moslah *et al*[68] carried out a study to examine the pattern of substance use among 298 persons with a history of drug use between 2010 and 2015. The results showed that among these cohort of young adults, cannabis was the most widely consumed illicit drug, followed by benzodiazepines, buprenorphine, cocaine, and ecstasy[68]. Reports from the Mediterranean School Survey Project on Alcohol and Other Drugs (II) carried out in Tunisia in 2017 revealed that tobacco, alcohol, and cannabis were the substances most frequently used by secondary school students[67], whereas psychotropic drugs such as ecstasy, cocaine, and buprenorphine were less frequently consumed. More importantly, it was observed that the frequency of use of these substances has increased significantly since the first survey published in 2014[66]. Chaouali *et al*[69] carried out an epidemiologic/toxicological investigation to evaluate patterns of drug abuse in 11170 suspected drug users. Urine samples collected between January 2016 and December 2018 were also analyzed. Results revealed a preponderance of males (97.4%) compared to females, with a median age of 29 ± 7.91 years. Also observed was that a large percentage of these drug users were single (91.3%). Examination of the urine samples revealed that about 48.4% tested positive for illicit drugs, with cannabis being the most widely consumed drug (95%), others were benzodiazepines, buprenorphine, cocaine, and opiates (0.13%). There was also a history of poly drug use[69].

In Southern Africa (although there are limited national data in most countries in the region), a rise in substance use has been reported[70]. In some of these countries including Zimbabwe, there is anecdotal evidence suggesting an increase in substance use among adolescents and young adults, with prevalence of substance use reportedly ranging from 6.1% to 13.8%[70]. Alcohol, cannabis, heroin, glue, and cough mixtures are among the most commonly consumed products in Zimbabwe. Cannabis, which is commonly known as mbanje, is grown locally (also smuggled into Zimbabwe from Malawi and Mozambique), and remains the most popular illicit drug among young Zimbabweans. Drugs are also trafficked through Zimbabwe to other countries in the region, including South Africa. In South Africa, an increase in substance use has been reported, which has been linked to the increased availability of illicit drugs including cannabis, cocaine, heroin, amphetamines, and ecstasy; either from diversion during trafficking or increased cultivation and local production[29,30,71,72]. Other factors that have contributed to the increase in substance use include an increase in migration and easing of border controls following the commencement of democracy, which have facilitated the development of youths'

movements that indirectly or directly promote substance use[30]. Results from surveys have revealed a gradual increase in cannabis consumption among adolescents and young adults in South Africa.

A 2002 school-based survey reported that 13% of the students (aged 19 years and below) had an history of cannabis use, although current use was 9%. About 12% had a current use of heroin, 11% used inhalants, and 6% consumed Mandrax[73]. The results of another study (a 2005 National household survey) showed that the prevalence in the past 3 mo for cannabis among 15-19-years-old was 3%[74]. In another study examining the prevalence and patterns of use of illicit substances among persons presenting at drug treatment centers in South Africa, it was revealed that cannabis (16.9%), methamphetamine (12.8%), cocaine (9.6%), and prescription drugs (2.6%) were the substances commonly used among patients. Also, there was evidence of poly drug use, with cannabis and mandrax having a prevalence of 3.4%, whereas heroin and opiates had a prevalence of 9.2%[75].

Prior to 1994 and the first democratic elections, alcohol, cannabis, and methaqualone were the primary substances of misuse in South Africa. With South Africa's transition to democracy and subsequent reopening of borders, there has been an influx of and a growing burden of harm associated with illicit drug use. Alcohol, however, remains the most commonly misused substance, with 14% of the population having a lifetime diagnosis of alcohol abuse and/or dependence (Herman *et al*[76], 2009). Although the overall levels of alcohol consumption do not exceed those in the developed world, the pattern of consumption differs markedly, with hazardous and binge drinking being common.

New and emerging psychoactive substances in Africa

Use of novel psychoactive substances is an emerging trend in substance use that is fast becoming a public health challenge globally[77,78]. Novel or new psychoactive substances have been defined by the United Nations Office on Drugs and Crime[79] as substances of abuse (existing either in its pure form or as a preparation) that are not controlled by either the 1961 or 1971 conventions on narcotic drugs and psychotropic substances, respectively, but pose significant threats to public health globally due to spikes in intoxications and fatalities associated with their use[79,80]. The term 'novel' or 'new' that is used in relation to these substances depicts their recent emergence in the global market. Substances that currently fall within the novel psychoactive substance category include (but are not limited to) synthetic cathinone and cannabinoids, synthetic opioids, image and performance-enhancing substances, tryptamine derivatives, piperazines, phencyclidine-like dissociatives, gamma amino-butyric acid (A)/beta receptor agonists, novel hallucinogens, benzodiazepines and psychotropic plants/herbs[77,81,82].

In the last few years or more, there has been a growing demand and supply chain for these new psychoactive substances[77,78,81]. In the last 10-12 years, the number of novel psychoactive substances has increased considerably. In 2009, only about 166 of them had been detected; however, by 2019, the number had risen to about 950, with more than 70% of these substances available in Europe[80,83]. While in the developed economies, a lot is being done to ensure continued documentation of novel psychoactive substances as they emerge, it would seem that Africa is only beginning to awaken to the emerging public health threat that these substances pose to her teeming population of adolescents and young adults[82]. While the lifetime prevalence of novel psychoactive substance use in countries such as the United States have been examined[80], there is a paucity of data on the prevalence of novel psychoactive substance use in Africa. Although across the continent, there is increasing awareness of the dangers of novel psychoactive substance use.

In 2017, attention was called to an increase in the use of designer drugs in Nigeria. Some of these substances which have street names such as "black mamba", Colorado", "Lamba", "happy boy", and" Scooby snax" are believed to contain synthetic cannabinoids. Their use is associated with a rise in the incidence of hallucinations, convulsions, psychiatric disorders, kidney failure and fatalities[84]. News outlets, including the British Broadcasting Corporation News and Premium Times, also reported that the use of and addiction to non-conventional psychoactive substances such as tramadol and codeine cough syrups among Nigerian youths was reaching epidemic proportions[85,86]. In Nigeria, available novel psychoactive substances also include mixtures with street names such as "gutter water", a cocktail of cannabis, tramadol, codeine and ethanol), and "monkey tail", a cocktail of locally made gin and cannabis (seeds, leaves, stems, and roots). Some people have also been in a state of euphoria from drinking the mixture of specific carbonated drinks and menthol flavored candies[82]. The sniffing of dry human fecal matter, dry cassava leaves and seeds, Datura metal seeds, Moringa leaf, burnt tires, sewer gas, and nail polish have also been reported[82,87]. Different parts of some lizards, including the whitish part of their dung, are also smoked in a bid to achieve a "high"[82,87]. The inhalation of urine, sewage, petrol, and glue are also common practice among drug users in Africa. It is believed that the hallucinogens present in hydrocarbons from petrol, and gases produced from fermentation of sewage have the ability to cause a "euphoric high" similar to (but longer lasting) when compared to that derived from the ingestion of cocaine[88].

In southern Africa, particularly South Africa, there have been reports of the use of "Nyaope" also known as "Whoonga", which is a cocktail of low-grade heroin (black tar heroin), marijuana, antiretroviral drugs (Efavirenz), and other undisclosed substances[88]. In East African countries such as Uganda and Kenya, the habit of using novel psychoactive substances such as the sniffing of aviation gas/jet fuel, toluene and glue is reaching epidemic proportions among persons aged between 16-25

years[89-91]. Other substances that are abused in this region include "kuber" and" shisha", also known as hookahs ,which are variants of smokeless tobacco. There have been reports that compared to cigarettes, the smoking of the shisha or hookah pipe exposes the user to higher volumes of smoke containing high levels of benzene, tar, and other carcinogens and increased risk of lung cancer[92-95].

In Northern Africa, the smoking of hashish and the chewing of Kath has become very rampant. Although there is little data from the region regarding the prevalence and patterns of use of novel psychoactive substances; reports from studies carried out in Egypt have suggested that the estimated prevalence of novel psychoactive substance use among adolescents in the country are largely underestimated[96]. However, tabloid reports have called attention to an increasing demand and use of novel psychoactive substances including "voodoo" and "strox" among adolescents and young adult in Egypt [97,98]. "Voodoo" is gaining popularity rapidly, and it is usually packaged and sold as an herbal incense. "Voodoo" is a heterogeneous mixture of several psychoactive substances, including synthetic cannabinoids, tramadol, amphetamine, methadone, benzodiazepines, penitrem A (a neurotoxin) and morphine derivatives. The concentrations of the chemical constituents and adulterants of voodoo also vary substantially among the different clandestine laboratories that produce it[96,99]. Another novel psychoactive substance that is gaining popularity in Egypt is "Strox"[100]. "Strox" or "Egyptian Spice" has been reported to account for approximately 4.3% of the over 10400 patients requiring medical support for drug-related complications[101]. Also, addiction to "strox" was responsible for 22% of calls to the addiction center hotline[101]. "Strox" is a potent synthetic narcotic that is mixed with tobacco and smoked; it is compounded in clandestine laboratories by adding veterinary grade chemicals to aromatic herbs such as marjoram. There have also been reports of the addition of pesticides to increase the potency, although this increases the toxicity[97].

The search for novel psychoactive substances is fueled by the need to create drugs that are able to evade the chemical processes used for detection and the legal processes that criminalizes the use and possession of conventional drugs of abuse. Also, the need for compounds that deliver fast and sustained psychoactive effects when compared to the conventional drugs also drive the search for novel psychoactive compounds[102]. However, the variability of the chemical constituents and/or adulterants of the different compounds present a conundrum for the health professional who has to decipher and manage the divergent symptoms and signs that complicate the use of these substances. Hence. there is an increasing need for continuous surveillance so that new or emerging psychoactive substances can be discovered before they wreak havoc on our communities.

African plants and herbs with psychostimulant potential: Are they being abused?

Several plants and parts of plants have been shown to have central nervous system effects[103-109]. Also, current literature reveals that novel psychoactive substances can be derived from either synthetic compounds or from bioactive principles of natural compounds. These bioactive principles which are mainly alkaloids are present in a wide variety of plants including Ayahuasca, Catha edulis and nicotiana tabacum; and have been reported to possess hallucinogenic and/or stimulant effects[110]. Plants with psychoactive properties are found all over the globe and have been used for centuries by humans, for religious, therapeutic and recreational purpose[111,112]. Studies have shown that the bioactive principles of these plants enable the profound alteration of the human perception allowing for divination, ancestral contact, and spiritual enlightenment[111-113].

Africa has a high floral diversity and a rich tradition of indigenous medicinal plant and herb use [111]. Africa is also rich in flora of medicinal plants that possess central nervous system effects[107]. Although there is a paucity of ethnobotanical surveys on African plants with psychoactive effects, evidence from African traditional healers and diviners who use plants such as the 'Ubulawu', a preparation containing *Sileneundulata* and *Synaptolepis* are pointers that there are plants indigenous to Africa that contain compound which have mood altering effects[113]. A few plant species that are indigenous to Africa, such as the Cola species (Cola nitida, and Cola acuminata), Catha edulis (Kath), Datura species (Datura stramonium), Pausinystalia yohimbe (Burantashi Pausinytalia yohimbe) and Tabernanthe iboga have reported psychoactive properties[111,114], and have been used recreationally (Table 2) for centuries in the countries in which they are cultivated. However, in recent times, the use of and dependence on some of these plants by adolescents and young adults (either alone or combined with established illicit drugs) is reaching epidemic proportions. In this section, we reviewed the abuse potential of some psychoactive plants that are indigenous to the African continent.

Kath (Catha edulis Forsk) is a flowering plant native to countries in East Africa and the Horn of Africa. Fresh young leaves and twigs from Kath are chewed daily by large populations of people for its psycho-stimulatory properties. The chewing of Kath dates back centuries, being a practice that is rooted in tradition, social custom and the culture of the indigenous populations[115]. It has been reported that more than 20 million people worldwide chew Khat[116,117]. Although traditionally a custom associated with older middle Eastern and Eastern African men, Khat's use is now expanding to include women and younger persons. In the Eastern region of Ethiopia, approximately 30% of adolescent girls and 70% of adolescent boys chew Khat. The active principle contained in Khat is cathinone (an alkaloid), which is a stimulant that causes excitement, appetite loss and euphoria[117]. In countries such as Somalia, Ethiopia, Djibouti, and Kenya, the dependence on Kath is warranting its consideration as a substance of abuse. In Somalia a law prohibiting the use, cultivation, importation and trade of Kath was enacted and

Table 2 African plants and herbs with psychostimulant potential

Region	Herbal preparation	Plant	Bioactive compound	Central nervous system activity	Toxicity	Ref.
East Africa	Khat chewing, drink made from dried leaves or smoking dried leaves	Catha Edulis	Phenylalkylamines and the cathedulins (Cathinone)	Improves performance, stay alert and to increase work capacity, excitement, appetite loss and euphoria	Memory impairment, sleeping disorders, liver toxicity, cardiovascular disease, psychosis and poor academic performance	[115, 117, 124-126]
West Africa	Different parts of the plant are smoked or used to make concoctions	Datura specie including stramonium and Datura metal	Atropine, scopolamine, and hyoscamine	Anticholinergic and hallucinogenic activity	Hyperthermia, tachycardia, delirium, pronounced amnesia, severe mydriasis, bizarre behaviors and painful photophobia	[135, 136, 141, 145-148]
West Africa	Root bark concoctions	Tabernanthe iboga	Ibogaine	Stimulatory, hallucinogenic, and sedative effects	Development of ataxia, tremor, cardiac toxicity, and death	[149-151]
South Africa	Ubulawu drink	Silene undulata and Synaptolepis	Triterpenoid saponins	Mood altering effects including stimulating vivid or lucid dreams	Confusion	[113]
South Africa	Chewed, smoked, snorted or swallowed	Sceletium tortuosum	Mesembrenone, mesembrenol, mesembrine and tortuosamine	Increased libido, decreased stress, euphoria and appetite suppression	Anxiety, headache, hypertension, irritability, insomnia and nausea	[154, 155]

enforced by comprehensive national program[118]. At about the same period (approximately two decades ago), Kath was also considered by the World Health Organization and classified as a drug of abuse, although its abuse potential was not thought to constitute a serious problem compared with that of alcohol or tobacco[119]. Across a region extending across Africa and the Middle East, predominantly among the Ethiopians, Somalians and Yemenis, approximately 5 to 20 million people use Kath[116,120], with the consumers engaged in the practice for the best part of a day resulting in a loss of manpower and national income[121,122]. In 2005, a survey by the World Health Organization revealed a prevalence of 20% Kath abuse in Kenya, exceeding the prevalence observed in most of the other countries in the region[123]. However, more recent studies are demonstrating that in spite of attempts by the respective countries to criminalize the use of Kath, Kath chewing is fast becoming a common practice among young adults in countries like Kenya, Ethiopia, Somalia, Djibouti[124-126]. In Ethiopia, a study carried out among academic staff of a university revealed that the lifetime prevalence of Kath chewing was 41%[126], while another study carried out among college students reported a prevalence of 42%[124]. In Kenya, a recent household survey revealed that the prevalence of current Kath chewing in the region was 36.8%[125], which would suggest a significant rise from the 20% prevalence reported by the World Health Organization[123]. While Kath chewing was not previously known outside the regions within which it was cultivated, the effects of migration and trade have propelled it to a widely used psychostimulant globally[115,127]. Kath chewing has been associated with adverse health effects that is creating public health challenges in countries across Asia, Europe, Australia, and the United States of America[128-130]. When chewed concurrently with tobacco, there have been reports of cardiovascular stress response[129]. It has also been associated with the alteration of physical, mental, social and cognitive aspects of human functioning[131]. Chewing Kath chronically has been reported to cause memory impairment, sleeping disorders, liver toxicity, cardiovascular disease, psychosis and poor academic performance[126,132]. While attempts are being made by countries to criminalize the importation and trade of Kath, smugglers continue to find new avenues and trade routes. For example, in 2016, the National Drug Law Enforcement Agency of Nigeria reported seizures of Kath load, which was possibly destined for the Nigerian market or enroute countries[133]. However, in 2020, the United States customs reported seizure of Kath load from Nigeria destined for the United States suggesting that Nigeria is fast becoming a Kath transit hub[134].

In Nigeria, complicating the substance abuse epidemic is the emerging trend of experimenting with plant extracts or brews from a group of flowering plants belonging to the Datura specie, of the nightshade family Solanaceae[135,136]. Although members of the Datura specie which are broadly known as thorn apple, devil's apple, devil's trumpet or angel's trumpet have their origin in central Americas and in the south-west region of the United States if America[137,138], they have become naturalized all over the world, being widespread in Asia, Europe, and Africa[139]. The datura specie is made up of herbs and shrubs with erect or branched stems, with alternate simple basal leaves and opposite leaves on terminal branches[139]. The fruit has a spiny capsule and reniform seeds[139,140]. All parts of the Datura stramonium and Datura metal plant has been shown to contain tropane alkaloids such as atropine, scopolamine, and hyoscyamine which have significant anticholinergic and hallucinogenic activity[141]. The high tropane alkaloid content of these plants increases their medicinal value and also opens them up to potential abuse. In Nigeria, Datura stramonium (thorn apple, devil's

snare, devil's trumpet or jimsonweed) and Datura metal (Indian thorn apple) are naturalized. Similar to a number of countries across the world (United States of America and Canada) where there has been reports of datura-induced poisoning among adolescents who abuse the plant for its hallucinogenic effects[142-144], adolescents and young adults in Nigeria are also experimenting with the plant and getting poisoned[136]. Datura metal grows wildly (although at times it is cultivated) across the different regions of Nigeria where it is called 'Myaramuo' by the Igbos of south eastern Nigeria, 'Zakami' by Hausas of northern Nigeria and 'Apikan' by the Yorubas of southwestern Nigeria[145,146]. Datura stramonium also grows as a weed and is also cultivated across the different states of Nigeria. It is known as 'Gegemu' by the Yorubas and 'Zakami' by the Hausas[136]. Both plants have been reported to have hallucinogenic and euphoric effects when the different parts of the plant are either smoked or used to make concoctions[147]. Datura stramonium poisoning is associated with hyperthermia, tachycardia, delirium, pronounced amnesia, severe mydriasis, bizarre behaviors and painful photophobia[136,148]. These features can appear as early as 30 min to 1 h following consumption of the extract or smoking of the weed and have been reported to last several hours to days or at times even as long as 2 wk[148].

Another plant with psychoactive properties is the Western African shrub Tabernanthe iboga from whose root bark ibogaine, a hallucinogenic alkaloid is extracted. Traditionally, the concoctions from the roots have been used for their stimulatory, hallucinogenic, and sedative effects[149]. Ibogaine has been reported to exhibit stimulant effects at low doses and result in the development of hallucinations at high doses. Its use has also been associated with the development of ataxia, tremor, cardiac toxicity, and death[149-151]. There have also been reports that ibogaine has anti-addictive properties, although its use is limited by its deleterious effects[152,153].

In southern Africa, the use of extracts, dried-powdered herb, tincture, tea bags and seeds of the plant sceletium tortuosum also known as Kanna is also gaining traction. These different compositions of the plant can be chewed, smoked, snorted or swallowed resulting in increased libido, decreased stress, euphoria and appetite suppression. There are reports attributing the antidepressant and mood-elevating effects of the plant to the serotoninergic activity of its alkaloids including mesembrenone, mesembrenol, mesembrine, and tortuosamine. Indiscriminate use has been associated with the development of anxiety, headache, hypertension, irritability, insomnia and nausea[154,155]. A serotonin syndrome has also been observed especially when consumed alongside selective serotonin reuptake inhibitors or monoamine oxidase inhibitors. Although the use of a number of these plants and herbs may not be illegal in the countries in which they are consumed, increasing reports of poisoning arising from the use or these psychoactive plants solely or in combination with other compounds is drawing attention to the need to enact public health laws that can criminalize their use.

Synthetic cannabinoid in herbal products

Synthetic cannabinoids are compounds which are structurally similar to natural cannabinoids [tetrahydrocannabinol and cannabidiol (CBD)] allowing them to exert their effect through binding to cannabinoid receptors (CBD1 and CBD2)[156,157]. Synthetic cannabinoids can be agonists at the CB_1 receptors or antagonists at other cannabinoid receptors. Although many of the synthetic cannabinoids are used in pharmacology in structure - activity relationships and receptor binding studies, others have medicinal uses including in the treatment of anorexia, as antiemetics in cancer chemotherapy and in pain management. In the last two decades, commercial preparations containing synthetic cannabinoids have become popular for their use as designer drugs marketed as herbal incense or herbal blends under the names 'Spice', 'synthetic marijuana', and 'K2'[158-160]. The cannabinoid compound is sprayed onto inert plant material and smoked or ingested in liquid form[160,161]. Although often considered legal and safe alternatives to cannabis, there is evidence indicating that synthetic cannabinoids use is associated with significant health risks when compared to marijuana; there have also been reports that their distinct pharmacological effects and metabolic activity could also be a contributing factor to the increased toxicity observed following their use[157,162,163].

To date, the abuse of herbal preparations that have been spiked with synthetic cannabinoids continues to increase. This is evidenced by an increasing list of commercial preparations marketed in the United States and Europe under the names fairly legal, Pandora's box, Angry birds, exodus, bonzai, annihilation, weekend blend, fire, strong spice, green Buddha, smoke, and Scooby snacks[102,164]. In the last few years, Africa is also beginning to experience a surge in demand for and use of synthetic cannabinoids. In Mauritius, since the year 2015, there has been a reported increase the number of arrests involving synthetic cannabinoids[165]. In different countries in the continent they are marketed under various street names including, Wiz in South Africa[166]. In Nigeria it is marketed as Black Mamba, Colorado, Lamba, Happy Boy or Scooby Snax[167].

Across Africa, available evidence points to a growing use of novel psychoactive compounds which mainly contain synthetic cannabinoids. Synthetic cannabinoids have effects that are similar to that experienced with natural cannabis, although they are more potent and have been associated with more severe physical and psychological adverse effects necessitating hospitalizations[168,169].

PREVALENCE OF SUBSTANCE USE DISORDERS AND AVAILABILITY OF EVIDENCE-BASED TREATMENT CENTRES IN AFRICA

Substance use disorders are defined as the persistent use of alcohol or other psychoactive substances despite significant harm and untoward health consequences[170]. They are characterized by an array of social, emotional and behavioral problems. Across Africa, there is also a dearth of scientific data on the prevalence of substance use disorders or drug dependence[48,55,56,171]. In Nigeria, reports from the 2018 National Drug Survey revealed that one in every five persons who used drug in the past year also had a drug-related disorder[48,55,56]. In South Africa, results obtained from a nationally representative sample of 4351 persons aged 18 years and above revealed a lifetime prevalence of substance use disorders of 13%, with alcohol use disorder being the most prevalent type of substance use disorders[72,171-173]. In Egypt, reports obtained from the National Addiction Research Study revealed the prevalence of drug dependence in the different regions ranged from 3.2%-9.3%[174].

Left untreated, substance use disorders contribute significantly to the global burden of disease, including increasing morbidity and mortality and societal cost implications such as increased healthcare costs, lost productivity and costs related to social welfare and criminal justice[4,5]. Access to evidence-based treatment has been linked with a reduction in the risk for ill health[171]. Accordingly, towards reducing the burden of substance use globally, availability and access to evidence-based treatment facility were included in the United Nations' Sustainable Development Goals for 2030[175]. However, despite reports of increasing prevalence of drug dependence and substance use disorders, reports from surveys carried out in a number of countries in Africa suggest that the availability of treatment centers are limited[171,176]. Factors contributing to this treatment gap include treatment infrastructure constraints, poor funding, and the high cost of private-for-profit treatment centers[171,176].

How can Africa's burgeoning substance use and substance use disorder problem be addressed

It has become evident that there is a burgeoning illicit drug use problem across the African continent[47-49,177]. There had been predictions that by the year 2050, increased life expectancy and a rapidly growing population would result in approximately 130% increase in the burden of mental and substance use disorders to about 45 million years lived with disability in Africa[178]. While different factors, including increased access to illicit drugs and high level of youth unemployment have been adduced to explain the emerging drug use pandemic; its significant contribution to economic instability, crime, criminality and insecurity across Africa and worldwide means that governments and policy makers need to prioritize the need to develop ways to mitigate these problems. The dearth of comprehensive data and the uniqueness of the manifestation of illicit drug use to individual countries within the African region are factors that impede progress towards addressing this looming pandemic.

Understanding the different determinants of drug use within the different populations of Africans and how these impact the prevention and treatment of substance abuse disorders in the individual countries would be an important step towards addressing this emerging pandemic. Currently available data suggests that influencers of drug use (particularly in adolescents) which include family, social networks and peer pressure are common to most of the countries[179-184]. Other determinants of drug use also include childhood trauma and adverse life experiences such as sexual, emotional or physical abuse. Across age groups, demographic factors such as being male, lower level of education and attendance of private schools have also been reported by researchers from the different regions of Africa [185-187].

In addition to understanding the influencers and determinants of drug use, there is also a need for up-to-date national and regional data that can adequately determine the prevalence and incidence of drug use across all demographics. The availability of a detailed and comprehensive national data would provide a background against which policy successes or failures can be measured, it would also alert governments and international partners on the need for increased funding or more treatment facilities.

The deleterious health effects of drug use disorders means that the provision of effective prevention, treatment and care facilities for substance use disorders is a necessary investment in the health of the society as a whole. Research has shown that the availability of evidence based prevention programs and policies have the ability to significantly reduce substance use and related harmful effects[188]. Behavioral and medication-assisted treatment using a chronic-illness-management approach has also been shown to aid recovery and prevent relapse. There have been suggestions that easy access to support services assist previous substance users to achieve and maintain wellness long-term[188].

Addressing the ease of access to drugs and other illicit substances within communities and regions need to be taken more seriously. There is a need to gather information on the different types of novel psychoactive substances that are available within communities and also create awareness as to the adverse health effects associated with consuming these compounds.

Limitations and recommendations

One of the major limitations encountered in this review was the dearth of recent, community based and age specific scientific data on the prevalence and extent of the substance abuse problems in most of the countries in Africa. There was also a deficit of data on the details and impact of the country-specific

intervention protocols. This led to reliance mainly on third party data from international; partners and a few independent researchers. The battle to win this emerging substance–use pandemic in Africa can only be successful if there is increased emphasis in documenting the extent of the problem and country specific interventions; particularly at the community levels with emphasis on how different age groups are impacted by substance abuse.

CONCLUSION

In Africa, substance use and substance use disorders drain struggling economies and health care systems. While the continent might have some general idea of what it is up against, understanding the details of the problem and availability of the willpower/wherewithal to subdue it remains a challenge. It is becoming obvious that there is no substitute for well-designed, accurate and comprehensive population-focused efforts at obtaining data that relates to substance use and substance use disorders, since such data will form the foundations for designing effective intervention strategies. Also, in Africa, interventional strategies should place emphasis on prevention, through identification of and mitigation of risk factors, as this approach is likely to consume less resources in the long run.

FOOTNOTES

Author contributions: All authors contributed to the writing of this article.

Conflict-of-interest statement: All the authors report no relevant conflicts of interest for this article.

Country/Territory of origin: Nigeria

ORCID number: Olakunle James Onaolapo 0000-0003-2142-6046; Anthony Tope Olofinnade 0000-0002-9492-9958; Foluso Olamide Ojo 0000-0002-5560-9740; Adejoke Yetunde Onaolapo 0000-0001-7126-7050.

S-Editor: Wang JJ
L-Editor: Filipodia
P-Editor: Wang JJ

REFERENCES

1 **Prom-Wormley EC**, Ebejer J, Dick DM, Bowers MS. The genetic epidemiology of substance use disorder: A review. *Drug Alcohol Depend* 2017; **180**: 241-259 [PMID: 28938182 DOI: 10.1016/j.drugalcdep.2017.06.040]
2 **United Nations Office on Drugs and Crime**. World Drug Report 2021. [cited 15 January 2022]. Available from: https://www.unodc.org/unodc/data-and-analysis/wdr2021.html
3 **World Health Organization**. Global health estimates: Leading causes of death. [cited 15 January 2022]. Available from: https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death
4 **Leikin JB**. Substance-related disorders in adults. *Dis Mon* 2007; **53**: 313-335 [PMID: 17645897 DOI: 10.1016/j.disamonth.2007.04.001]
5 **GBD 2016 Alcohol and Drug Use Collaborators**. The global burden of disease attributable to alcohol and drug use in 195 countries and territories, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Psychiatry* 2018; **5**: 987-1012 [PMID: 30392731 DOI: 10.1016/S2215-0366(18)30337-7]
6 **GBD 2017 Disease and Injury Incidence and Prevalence Collaborators**. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018; **392**: 1789-1858 [PMID: 30496104 DOI: 10.1016/S0140-6736(18)32279-7]
7 **World Health Organization**. Regional Office For Africa 2021. [cited 15 January 2022]. Available from: https://www.afro.who.int/
8 **Wyler LS**, Cook N. Illegal Drug Trade in Africa: Trends and U.S. Policy. Washington: Congressional Research Service, 2009
9 **Csete J**, Sánchez C. Telling the story of drugs in West Africa: The newest front in a losing war? Global Drug Policy Observatory, Swansea University, 2013
10 **McGovern PE**, Zhang J, Tang J, Zhang Z, Hall GR, Moreau RA, Nuñez A, Butrym ED, Richards MP, Wang CS, Cheng

G, Zhao Z, Wang C. Fermented beverages of pre- and proto-historic China. *Proc Natl Acad Sci U S A* 2004; **101**: 17593-17598 [PMID: 15590771 DOI: 10.1073/pnas.0407921102]
11 **Norn S**, Kruse PR, Kruse E. [History of opium poppy and morphine]. *Dan Medicinhist Arbog* 2005; **33**: 171-184 [PMID: 17152761]
12 **Crocq MA**. Historical and cultural aspects of man's relationship with addictive drugs. *Dialogues Clin Neurosci* 2007; **9**: 355-361 [PMID: 18286796 DOI: 10.31887/DCNS.2007.9.4/macrocq]
13 **O'Brien JM**. Alexander and Dionysus: the invisible enemy: a biography. New York: Routledge, 1992
14 **Berrios G**, Porter R. A History of Clinical Psychiatry The Origin and History of Mental Disorders. London: The Athlone Press, 1995: 656
15 **United Nations**. World Drug Report 2019. [cited 15 January 2022]. Available from: https://www.unodc.org/unodc/en/data-and-analysis/wdr2021.html
16 **Merikangas KR**, McClair VL. Epidemiology of substance use disorders. *Hum Genet* 2012; **131**: 779-789 [PMID: 22543841 DOI: 10.1007/s00439-012-1168-0]
17 **United Nations Office on Drugs and Crime**. World Drug Report 2018. [cited 15 January 2022]. Available from: https://www.unodc.org/wdr2018/
18 **Hill BG**. Chat (Catha edulis forsk). *J Ethiop Stud* 1965; **3**: 13-23
19 **Acuda W**, Othieno CJ, Obondo A, Crome IB. The epidemiology of addiction in Sub-Saharan Africa: a synthesis of reports, reviews, and original articles. *Am J Addict* 2011; **20**: 87-99 [PMID: 21314750 DOI: 10.1111/j.1521-0391.2010.00111.x]
20 **Ambler C**. The drug empire: control of drugs in Africa, a global perspective. In: Klantschnig G, Carrier N, Ambler C. Drugs in Africa: histories and ethnographies of use, trade and control. New York: Palgrave Macmillan, 2014: 25-47
21 **Eligh J**. The evolution of illicit drug markets and drug policy in Africa. Jun 30, 2019. [cited 15 January 2022]. Available from: https://enactafrica.org/research/continental-reports/the-evolution-of-illicit-drug-markets-and-drug-policy-in-africa
22 **Herbert M**, Gallien M. A rising tide Trends in production, trafficking and consumption of drugs in North Africa. Switzerland: Global Initiative Against Transnational Organized Crime, 2020
23 **Ellis S**. West Africa's International Drug Trade. *Afr Aff* 2009; **108**: 171-196 [DOI: 10.1093/afraf/adp017]
24 **Akyeampong E**. Diaspora and Drug Trafficking in West Africa: A Case Study of Ghana. *Afr Aff* 2005; **104**: 429-447 [DOI: 10.1093/afraf/adi015]
25 **United Nations**. World Drug report 2011. [cited 15 January 2022]. Available from: https://www.unodc.org/unodc/en/data-and-analysis/WDR-2011.html
26 **United Nations Office on Drugs and Crime**. Regional Programme West Africa 2010-2014. [cited 15 January 2022]. Available from: https://www.unodc.org/documents/evaluation/indepth-evaluations/2015/RP_West_Africa_Final_In-Depth_Evaluation_Report_Dec_2015.pdf
27 **Aning K**, Pokoo J. Understanding the nature and threats of drug trafficking to national and regional security in West Africa. *Stability: Int J Secur Dev* 2014; **3**: p.Art. 8 [DOI: 10.5334/sta.df]
28 **Aucoin C**. Analysing drug trafficking in East Africa A media-monitoring approach. Jul 2, 2018. [cited 15 January 2022]. Available from: https://enactafrica.org/research/research-papers/analysing-drug-trafficking-in-east-africa-a-media-monitoring-approach
29 **Pasche S**, Myers B. Substance misuse trends in South Africa. *Hum Psychopharmacol* 2012; **27**: 338-341 [PMID: 22585594 DOI: 10.1002/hup.2228]
30 **United Nations Office on Drugs and Crime**. South Africa country profile on drugs and crime. [cited 15 January 2022]. Available from: https://www.unodc.org/pdf/southafrica/country_profile_southafrica_1.pdf
31 **Kibble S**. Drugs and development in South Africa: How Europe could help. London: Catholic Institute for International Relations, 1998
32 **Parry C**. The illegal narcotics trade in Southern Africa: A programme for action. *South African Institute of International Affairs* 1997; **5**: 38-70 [DOI: 10.1080/10220469709545209]
33 **Obervatoire Geopolitique des Drogues**. The Geopolitical Drug Dispatch. Boston: Northeastern University Press, 1996: 235
34 **Affinnih YH**. A review of literature on drug use in Sub-Saharan Africa countries and its economic and social implications. *Subst Use Misuse* 1999; **34**: 443-454 [PMID: 10082066 DOI: 10.3109/10826089909035655]
35 **Anochie IC**, Nkanginieme KEO. Social correlates of drug use among secondary school students in Port Harcourt, Southern Nigeria. *Sahel Med J* 2000; **3**: 87-92
36 **Ayuba LS**, Audu DM. Alcohol and illicit drug abuse among children and adolescents in Jos Nigeria. *Highland Med Res J* 2005; **1**: 18-22 [DOI: 10.4314/hmrj.v1i3.33809]
37 **Lamptey J**. Socio-demographic Characteristics of Substance Abusers Admitted to a Private Specialist Clinic. *Ghana Med J* 2005; **39**: 2-7 [PMID: 17299533 DOI: 10.4314/gmj.v39i1.35973]
38 **Bronwyn M**, Charles DHP. Access to substance abuse treatment services for black South Africans: Findings from audits of specialist treatment. *African J Psychiatry* 2005; **8** [DOI: 10.4314/ajpsy.v8i1.30179]
39 **Betencourt OA**, Herrera MM. Alcohol and drug problems and sexual and physical abuse at three urban high schools in Mthatha. *SAFP* 2006; **48**: 17-17c [DOI: 10.1080/20786204.2006.10873369]
40 **Okwaraji FE**. Substance abuse among secondary school adolescents in Enugu. *J Med College* 2006
41 **Ngesu LM**, Ndiku J, Masese A. Drug dependence and abuse in Kenyan secondary schools: Strategies for intervention. *Educ Res Rev* 2008; **3**: 304-308 [DOI: 10.5897/ERR.9000107]
42 **World Health Organization**. Global Status Report on Alcohol 2004. [cited 15 January 2022]. Available from: https://www.who.int/publications/i/item/global-status-report-on-alcohol-2004
43 **Morojele NK**, Brook JS. Substance use and multiple victimisation among adolescents in South Africa. *Addict Behav* 2006; **31**: 1163-1176 [PMID: 16253426 DOI: 10.1016/j.addbeh.2005.09.009]
44 **United Nations Office on Drugs and Crime**. Cannabis in Africa. [cited 15 January 2022]. Available from:

https://www.unodc.org/documents/data-and-analysis/Can_Afr_EN_09_11_07.pdf
45 **Olawole-Isaac A**, Ogundipe O, Amoo EO, Adeloye D. Substance use among adolescents in sub-Saharan Africa: a systematic review and meta-analysis. *S Afr J Child Health* 2018; **12**: 79 [DOI: 10.7196/SAJCH.2018.v12i2b.1524]
46 **United Nations Office on Drugs and Crime**. World Drug Report 2013. [cited 15 January 2022]. Available from: https://www.unodc.org/unodc/en/scientists/world-drug-report-2013.html
47 **United Nations Office on Drugs and Crime**. World Drug Report 2016. [cited 15 January 2022]. Available from: https://www.unodc.org/wdr2016/
48 **United Nations Office on Drugs and Crime**. Drug use in Nigeria. [cited 15 January 2022]. Available from: https://www.unodc.org/documents/data-and-analysis/statistics/Drugs/Drug_Use_Survey_Nigeria_2019_BOOK.pdf
49 **United Nations Office on Drugs and Crime**. World Drug Report 2019. [cited 15 January 2022]. Available from: https://wdr.unodc.org/wdr2019/
50 **Owusu A**. Ghana Country report on the global school-based health survey (GSHS). Atlanta: Center for Disease Control and Prevention, 2008
51 **Adu-Mireku S**. The Prevalence of Alcohol, Cigarette, and Marijuana Use Among Ghanaian Senior Secondary Students in an Urban Setting. *J Ethn Subst Abuse* 2003; **2**: 53-65 [DOI: 10.1300/J233v02n01_05]
52 **Oppong Asante K**, Meyer-Weitz A, Petersen I. Substance use and risky sexual behaviours among street connected children and youth in Accra, Ghana. *Subst Abuse Treat Prev Policy* 2014; **9**: 45 [PMID: 25428774 DOI: 10.1186/1747-597X-9-45]
53 **Idris SH**, Sambo MN. Psycho-active substance use among in-school adolescents in Zaria, north western Nigeria: what are the triggers? *Niger J Med* 2009; **18**: 291-294 [PMID: 20120648 DOI: 10.4314/njm.v18i3.51191]
54 **Idowu A**, Aremu AO, Olumide A, Ogunlaja AO. Substance abuse among students in selected secondary schools of an urban community of Oyo-state, South West Nigeria: implication for policy action. *Afr Health Sci* 2018; **18**: 776-785 [PMID: 30603011 DOI: 10.4314/ahs.v18i3.36]
55 **United Nations Office on Drugs and Crime**. Drug use in Nigeria Executive summary. [cited 15 January 2022]. Available from: https://www.unodc.org/documents/data-and-analysis/statistics/Drugs/Drug_Use_Survey_Nigeria_2019_Exsum.pdf
56 **Jatau AI**, Sha'aban A, Gulma KA, Shitu Z, Khalid GM, Isa A, Wada AS, Mustapha M. The Burden of Drug Abuse in Nigeria: A Scoping Review of Epidemiological Studies and Drug Laws. *Public Health Rev* 2021; **42**: 1603960 [PMID: 33796340 DOI: 10.3389/phrs.2021.1603960]
57 **Teferra S**. Substance use among university students in Ethiopia: A systematic review and meta-analysis. *Ethiop J Health Dev* 2018; **32**: 265-277
58 **Abajobir AA**, Kassa GM. A meta-analytic review of gender disparity in the magnitude of substance use among young people in Ethiopia. *Ethiop Med J* 2019; **57**: 295-307
59 Central Statistical Agency [Ethiopia] and ICF International. Ethiopia demographic and health survey. Addis Ababa and Calverton: Central Statistical Agency and ICF International, 2011: 2012
60 **Girma E**, Mulatu T, Ketema B. Polysubstance use behavior among the male population in Ethiopia: Findings from the 2016 Ethiopia Demographic and Health Survey. *Ethiop J Health Dev* 2020; **34**
61 **Adere A**, Yimer NB, Kumsa H, Liben ML. Determinants of psychoactive substances use among Woldia University students in Northeastern Ethiopia. *BMC Res Notes* 2017; **10**: 441 [PMID: 28870246 DOI: 10.1186/s13104-017-2763-x]
62 **Gebreslassie M**, Feleke A, Melese T. Psychoactive substances use and associated factors among Axum University students, Axum Town, North Ethiopia. *BMC Public Health* 2013; **13**: 693 [PMID: 23895376 DOI: 10.1186/1471-2458-13-693]
63 **Shegute T**, Wasihun Y. Prevalence of Substance Use in University Students, Ethiopia. *Subst Abuse* 2021; **15**: 11782218211003558 [PMID: 33854324 DOI: 10.1177/11782218211003558]
64 **Badri N**. Drug Policy in Tunisia: Towards an Evidence based Human Rights and Public Health Approach. Tunisia: Centre for Applied Policy Research, 2017
65 **Taha M**, Taalab YM, Abo-Elez WF, Eldakroory SA. Cannabis and Tramadol are Prevalent among the First Episode Drug-Induced Psychosis in the Egyptian Population: Single Center Experience. *Reports* 2019; **2**: 16 [DOI: 10.3390/reports2020016]
66 **Aounallah-skhiri H**, Zalila H, Zid T, Boukassoula H, Ben Salah N. Drug situation and policy in Tunisia. [cited 15 January 2022]. Available from: https://rm.coe.int/drug-situation-and-policy-by-pr-hajer-aounallah-skhiri-medecin-epidemi/168075f2a4
67 Résultats de l'enquête nationale MedSPAD II (Mediterranean School Survey Project on Alcohol and Other Drugs). [cited 15 January 2022]. Available from: https://rm.coe.int/2017-ppg-med-41-medspad-tunisia-report-fra/16808cbf44
68 **Moslah B**, Araoud M, Nouioui MA, Najjar S, Amira D, Ben Salah N, Hedhili A. Fast screening tests for the simultaneous detection of 11 drugs of abuse in urine specimens. A forensic epidemiology study of 28,298 cases in Tunisia. *Forensic Sci Int* 2018; **283**: 35-40 [PMID: 29248810 DOI: 10.1016/j.forsciint.2017.12.004]
69 **Chaouali N**, Moslah B, Salem KB, Amira D, Hedhili A, Salah NB. Illicit substances identified in the urine of 11.170 suspected drug users in North Tunisia. *Pan Afr Med J* 2021; **38**: 20 [PMID: 34567345 DOI: 10.11604/pamj.2021.38.20.26781]
70 **Matutu V**, Mususa D. Drug and Alcohol Abuse Among Young People in Zimbabwe: A Crisis of Morality or Public Health Problem. *SSRN Electron J* 2019 [DOI: 10.2139/ssrn.3489954]
71 **Atkins A**. The illegal drugs trade and development in South Africa: some observations. London: Catholic Institute for International Relations, 1997
72 **Manu E**, Douglas M, Ayanore MA. Socio-ecological influences of adolescence marijuana use initiation: Qualitative evidence from two illicit marijuana-growing communities in South Africa. *S Afr J Psychiatr* 2020; **26**: 1477 [PMID: 32934841 DOI: 10.4102/sajpsychiatry.v26i0.1477]
73 **Reddy SP**, Panday S, Swart D, Jinabhai CC, Amosun SL, James S, Monyeki KD, Stevens G, Morejele N, Kambaran NS,

Omardien RG, Van den Borne HW. Umthenthe Uhlaba Usamila - The 1st South African Youth Risk Behaviour Survey 2002. Cape Town: South African Medical Research Council, 2003

74 **Shisana O**, Rehle T, Simbayi LC, Parker W, Zuma K, Bhana A, Connolly C, Jooste S, Pillay V. South African National HIV prevalence, HIV incidence, Behaviour and Communication Survey. Cape Town: HSRC Press, 2005

75 **Peltzer K**, Ramlagan S, Johnson BD, Phaswana-Mafuya N. Illicit drug use and treatment in South Africa: a review. *Subst Use Misuse* 2010; **45**: 2221-2243 [PMID: 21039113 DOI: 10.3109/10826084.2010.481594]

76 **Herman AA**, Stein DJ, Seedat S, Heeringa SG, Moomal H, Williams DR. The South African Stress and Health (SASH) study: 12-month and lifetime prevalence of common mental disorders. *S Afr Med J* 2009; **99**: 339-344 [PMID: 19588796]

77 **Elliott S**, Evans J. A 3-year review of new psychoactive substances in casework. *Forensic Sci Int* 2014; **243**: 55-60 [PMID: 24810679 DOI: 10.1016/j.forsciint.2014.04.017]

78 **Peacock A**, Bruno R, Gisev N, Degenhardt L, Hall W, Sedefov R, White J, Thomas KV, Farrell M, Griffiths P. New psychoactive substances: challenges for drug surveillance, control, and public health responses. *Lancet* 2019; **394**: 1668-1684 [PMID: 31668410 DOI: 10.1016/S0140-6736(19)32231-7]

79 **UNODC**. UNODC Early Warning Advisory on New Psychoactive substances. [cited 15 January 2022]. Available from: https://www.unodc.org/LSS/Home/NPS

80 **Neicun J**, Yang JC, Shih H, Nadella P, van Kessel R, Negri A, Czabanowska K, Brayne C, Roman-Urrestarazu A. Lifetime prevalence of novel psychoactive substances use among adults in the USA: Sociodemographic, mental health and illicit drug use correlates. Evidence from a population-based survey 2007-2014. *PLoS One* 2021; **16**: e0251006 [PMID: 33125395 DOI: 10.1371/journal.pone.0241056]

81 **Vicknasingam B**, Narayanan S, Singh D, Corazza O. Global strategy for New Psychoactive Substances: an update. *Curr Opin Psychiatry* 2020; **33**: 295-300 [PMID: 32398543 DOI: 10.1097/YCO.0000000000000612]

82 **Dumbili EW**, Ebuenyi ID, Ugoeze KC. New psychoactive substances in Nigeria: A call for more research in Africa. *Emerging Trends Drugs, Addictions, Health* 2021; **1**: 100008 [DOI: 10.1016/j.etdah.2021.100008]

83 **European Monitoring Centre for Drugs and Drug Addiction**. European Drug Report 2020: Trends and Developments. [cited 15 January 2022]. Available from: https://www.emcdda.europa.eu/publications/edr/trends-developments/2020_en

84 **Akande S**. A new deadly form of marijuana is slowly wreaking havoc in Nigeria's cities. Jul 24, 2017. [cited 15 January 2022]. Available from: https://www.pulse.ng/gist/synthetic-marijuana-black-mamba-a-new-deadly-form-of-marijuana-is-slowly-wreaking/r4dmxpn#:~:text=A%20new%20deadly%20form%20of%20marijuana%20is%20slowly,that%20can%20lead%20to%20death.%20%7C%20Pulse%20Nigeria

85 **Premium Times**. Katsina NDLEA seizes trailer loaded with codeine cough syrups. Mar 20, 2018. [cited 15 January 2022]. Available from: https://www.premiumtimesng.com/regional/nwest/262409-katsina-ndlea-seizes-trailer-loaded-with-codeine-cough-syrups.html

86 Nigeria's Deadly Codeine Cough Syrup Epidemic. 2021. London: BBC News

87 **Danjuma A**, Taiwo A, Omoniyi S, Balarabe S, Kolo S, Sarah S, Nassa Y. Nonconventional use of substances among youth in Nigeria: viewpoints of students in a Nigerian Tertiary Institution. *J Nurs Care* 2015 [DOI: 10.4172/2167-1168.1000311]

88 **Ong'olo JM**. An Overview of Drug Use in Africa - a Continental Perspective. [cited 15 January 2022]. Available from: https://www.issup.net/files/2020-09/Overview%20of%20Drug%20Use%20in%20Africa%20-%20JMO-AU_15.9.20.pdf

89 Nairobi Glue Pusher Preys on Addicted Kids to Help Her Own. Rear Window [Film]; 2012. Boston: The World from PRX

90 Inside the dark world of sniffing fuel. January 23, 2018. [cited 15 January 2022]. Available from: https://www.monitor.co.ug/uganda/news/insight/inside-the-dark-world-of-sniffing-fuel-1737140

91 **Dutta NS**, Roy SD. Are Kenyan kids turning into Zombies? Read to know more about the horrifying documentary 'Zombies of Nairobi'. [cited 15 January 2022]. Available from: https://www.northeasternchronicle.in/news/are-kenyan-kids-turning-into-zombies-read-to-know-more-about-the-horrifying-documentary-zombies-of-nairobi/

92 **Blank MD**, Cobb CO, Kilgalen B, Austin J, Weaver MF, Shihadeh A, Eissenberg T. Acute effects of waterpipe tobacco smoking: a double-blind, placebo-control study. *Drug Alcohol Depend* 2011; **116**: 102-109 [PMID: 21277706 DOI: 10.1016/j.drugalcdep.2010.11.026]

93 **Shihadeh A**, Salman R, Jaroudi E, Saliba N, Sepetdjian E, Blank MD, Cobb CO, Eissenberg T. Does switching to a tobacco-free waterpipe product reduce toxicant intake? *Food Chem Toxicol* 2012; **50**: 1494-1498 [PMID: 22406330 DOI: 10.1016/j.fct.2012.02.041]

94 **Qasim H**, Alarabi AB, Alzoubi KH, Karim ZA, Alshbool FZ, Khasawneh FT. The effects of hookah/waterpipe smoking on general health and the cardiovascular system. *Environ Health Prev Med* 2019; **24**: 58 [PMID: 31521105 DOI: 10.1186/s12199-019-0811-y]

95 **Kahuthia-Gathu R**, Okwarah P, Gakunju R, Thungu J. Trends and emerging drugs in Kenya: A case study in Mombasa and Nairobi County. *J Appl Biosci* 2013; **67**: 5308 [DOI: 10.4314/jab.v67i0.95055]

96 **Hussien R**, El-Setouhy M, Shinawi ME, El-Hariri HM, Hirshon JM. Acute Toxic Effects of the New Psychoactive Substance "Voodoo" among Patients presented to the Poison Control Center of Ain Shams University Hospitals (PCC-ASUH), Egypt, during 2017. *Subst Abuse Treat Prev Policy* 2021; **16**: 71 [PMID: 34544462 DOI: 10.1186/s13011-021-00408-4]

97 **Abdelaty A**. Egypt says cheap new drug 'Strox' threatens its youth Healthcare Pharma. Nov 20, 2018. [cited 15 January 2022]. Available from: https://www.arabnews.com/node/1408131/middle-east

98 Voodoo and Strox: the synthetic drugs wreaking havoc in Cairo. The France 24 Observers. 23 Jul 2018. Available from: https://observers.france24.com/en/voodoo-strox-synthetic-drugs-wreaking-havoc-cairo

99 **Hussien R**, Ahmed S, Awad H, El-Setouhy M, El-Shinawi M, Hirshon JM. Identification of 'Voodoo': an emerging substance of abuse in Egypt. *Int J Environ Anal Chem* 2022; **102**: 104-116 [PMID: 35002018 DOI: 10.1080/03067319.2020.1715384]

100 **El-Masry M**, Abdelkader SI. Clinical profile of designer drug "Strox" intoxicated cases presented to Poison control center

Ain Shams University, Egypt from first of January 2017 to end of January 2018. *Ain Shams J Forensic Med Clin Toxicol* 2021; **36**: 98-105 [DOI: 10.21608/ajfm.2021.138857]

101 **Hashim AMM**, Hassan AM, Amin GE, Allam MF. Prevalence of Strox Smoking Among University Students in Cairo, Egypt. *Open Public Health J* 2020; **13**: 425-429 [DOI: 10.2174/1874944502013010425]

102 **Hassan Z**, Bosch OG, Singh D, Narayanan S, Kasinather BV, Seifritz E, Kornhuber J, Quednow BB, Müller CP. Novel Psychoactive Substances-Recent Progress on Neuropharmacological Mechanisms of Action for Selected Drugs. *Front Psychiatry* 2017; **8**: 152 [PMID: 28868040 DOI: 10.3389/fpsyt.2017.00152]

103 **Olofinnade AT**, Alawode A, Onaolapo AY, Onaolapo OJ. Lepidium meyenii Supplemented Diet Modulates Neurobehavioral and Biochemical Parameters in Mice Fed High-Fat High-Sugar Diet. *Endocr Metab Immune Disord Drug Targets* 2021; **21**: 1333-1343 [PMID: 32955007 DOI: 10.2174/1871530320666200821155005]

104 **Olofinnade AT**, Onaolapo AY, Stefanucci A, Mollica A, Olowe OA, Onaolapo OJ. Cucumeropsis mannii reverses high-fat diet induced metabolic derangement and oxidative stress. *Front Biosci (Elite Ed)* 2021; **13**: 54-76 [PMID: 33048776 DOI: 10.2741/872]

105 **Olofinnade AT**, Onaolapo AY, Onaolapo OJ, Olowe OA, Mollica A, Zengin G, Stefanucci A. Corylus avellana L. modulates neurobehaviour and brain chemistry following high-fat diet. *Front Biosci (Landmark Ed)* 2021; **26**: 537-551 [PMID: 33049682 DOI: 10.2741/4906]

106 **Olofinnade AT**, Onaolapo AY, Onaolapo OJ, Olowe OA. Hazelnut Modulates Neurobehaviour and Ameliorates Ageing-induced Oxidative Stress, and Caspase-3-Mediated Apoptosis in Mice. *Curr Aging Sci* 2021; **14**: 154-162 [PMID: 33371863 DOI: 10.2174/1874609813666201228112349]

107 **Onaolapo AY**, Onaolapo OJ. African Plants with Antidiabetic Potentials: Beyond Glycaemic Control to Central Nervous System Benefits. *Curr Diabetes Rev* 2020; **16**: 419-437 [PMID: 31702529 DOI: 10.2174/1573399815666191106104941]

108 **Onaolapo AY**, Abdusalam SZ, Onaolapo OJ. Silymarin attenuates aspartame-induced variation in mouse behaviour, cerebrocortical morphology and oxidative stress markers. *Pathophysiology* 2017; **24**: 51-62 [PMID: 28254270 DOI: 10.1016/j.pathophys.2017.01.002]

109 **Onaolapo OJ**, Odeniyi AO, Onaolapo AY. Parkinson's Disease: Is there a Role for Dietary and Herbal Supplements? *CNS Neurol Disord Drug Targets* 2021; **20**: 343-365 [PMID: 33602107 DOI: 10.2174/1871527320666210218082954]

110 **Lo Faro AF**, Di Trana A, La Maida N, Tagliabracci A, Giorgetti R, Busardò FP. Biomedical analysis of New Psychoactive Substances (NPS) of natural origin. *J Pharm Biomed Anal* 2020; **179**: 112945 [PMID: 31704129 DOI: 10.1016/j.jpba.2019.112945]

111 **Stafford GI**, Jäger AK, Staden JV. African Psychoactive Plants. In: African Natural Plant Products: New Discoveries and Challenges in Chemistry and Quality. Washington: American Chemical Society, 2010: 323-346

112 **Umit Sayin H**. Psychoactive Plants Used during Religious Rituals. In: Victor RP. Neuropathology of Drug Addictions and Substance Misuse. London: Academic Press, 2016: 17-28

113 **Sobiecki JF**. Psychoactive ubulawu spiritual medicines and healing dynamics in the initiation process of Southern Bantu diviners. *J Psychoactive Drugs* 2012; **44**: 216-223 [PMID: 23061321 DOI: 10.1080/02791072.2012.703101]

114 **Oestreich-Janzen S**. Caffeine: Characterization and Properties. In: Caballero B, Finglas PM, Toldrá F. Encyclopedia of Food and Health. London: Academic Press, 2016: 556-572

115 **Patel NB**. "Natural Amphetamine" Khat: A Cultural Tradition or a Drug of Abuse? *Int Rev Neurobiol* 2015; **120**: 235-255 [PMID: 26070760 DOI: 10.1016/bs.irn.2015.02.006]

116 **Corkery J**, Schifano F, Oyefeso A, Ghodse AH, Tonia T, Naidoo V, Button J. 'Bundle of fun' or 'bunch of problems'? *Drugs Educ Prev Policy* 2011; **18**: 408-425 [DOI: 10.3109/09687637.2010.504200]

117 **Malasevskaia I**, Al-Awadhi AA, Mohammed L. Tea in the Morning and Khat Afternoon: Health Threats Due to Khat Chewing. *Cureus* 2020; **12**: e12363 [PMID: 33527046 DOI: 10.7759/cureus.12363]

118 **Elmi AS**, Ahmed YH, Samatar MS. Experience in the control of khat-chewing in Somalia. *Bull Narc* 1987; **39**: 51-57 [PMID: 2896525]

119 **Al-Juhaishi T**, Al-Kindi S, Gehani A. Khat: A widely used drug of abuse in the Horn of Africa and the Arabian Peninsula: Review of literature. *Qatar Med J* 2012; **2012**: 1-6 [PMID: 25003033 DOI: 10.5339/qmj.2012.2.5]

120 **Mateen FJ**, Cascino GD. Khat chewing: a smokeless gun? *Mayo Clin Proc* 2010; **85**: 971-973 [PMID: 21037041 DOI: 10.4065/mcp.2010.0658]

121 **Chapman MH**, Kajihara M, Borges G, O'Beirne J, Patch D, Dhillon AP, Crozier A, Morgan MY. Severe, acute liver injury and khat leaves. *N Engl J Med* 2010; **362**: 1642-1644 [PMID: 20427816 DOI: 10.1056/NEJMc0908038]

122 **Gudata ZG**, Cochrane L, Imana G. An assessment of khat consumption habit and its linkage to household economies and work culture: The case of Harar city. *PLoS One* 2019; **14**: e0224606 [PMID: 31689323 DOI: 10.1371/journal.pone.0224606]

123 **World Health Organization**. Expert Committee on Drug Dependence. [cited 15 January 2022]. Available from: https://www.who.int/groups/who-expert-committee-on-drug-dependence

124 **Teni FS**, Surur AS, Hailemariam A, Aye A, Mitiku G, Gurmu AE, Tessema B. Prevalence, Reasons, and Perceived Effects of Khat Chewing Among Students of a College in Gondar Town, Northwestern Ethiopia: A Cross-Sectional Study. *Ann Med Health Sci Res* 2015; **5**: 454-460 [PMID: 27057386 DOI: 10.4103/2141-9248.177992]

125 **Ongeri L**, Kirui F, Muniu E, Manduku V, Kirumbi L, Atwoli L, Agure S, Wanzala P, Kaduka L, Karimi M, Mutisya R, Echoka E, Mutai J, Mathu D, Mbakaya C. Khat use and psychotic symptoms in a rural Khat growing population in Kenya: a household survey. *BMC Psychiatry* 2019; **19**: 137 [PMID: 31064338 DOI: 10.1186/s12888-019-2118-3]

126 **Yeshaw Y**, Zerihun MF. Khat chewing prevalence and correlates among university staff in Ethiopia: a cross-sectional study. *BMC Res Notes* 2019; **12**: 673 [PMID: 31639065 DOI: 10.1186/s13104-019-4706-1]

127 **Nencini P**, Grassi MC, Botan AA, Asseyr AF, Paroli E. Khat chewing spread to the Somali community in Rome. *Drug Alcohol Depend* 1989; **23**: 255-258 [PMID: 2568922 DOI: 10.1016/0376-8716(89)90089-6]

128 **Al-Samarraie M**, Khiabani HZ, Opdal MS. [Khat--a new drug of abuse in Norway]. *Tidsskr Nor Laegeforen* 2007; **127**: 574-576 [PMID: 17332809]

129 **al'Absi M**, Nakajima M, Dokam A, Sameai A, Alsoofi M, Saem Khalil N, Al Habori M. Concurrent tobacco and khat use is associated with blunted cardiovascular stress response and enhanced negative mood: a cross-sectional investigation. *Hum Psychopharmacol* 2014; **29**: 307-315 [PMID: 24706595 DOI: 10.1002/hup.2403]

130 **El-Menyar A**, Mekkodathil A, Al-Thani H, Al-Motarreb A. Khat use: history and heart failure. *Oman Med J* 2015; **30**: 77-82 [PMID: 25960830 DOI: 10.5001/omj.2015.18]

131 **Gebrie A**, Alebel A, Zegeye A, Tesfaye B. Prevalence and predictors of khat chewing among Ethiopian university students: A systematic review and meta-analysis. *PLoS One* 2018; **13**: e0195718 [PMID: 29649253 DOI: 10.1371/journal.pone.0195718]

132 **Vento S**, Dzudzor B, Cainelli F, Tachi K. Khat-related liver disease in sub-Saharan Africa: neglected, yet important - Authors' reply. *Lancet Glob Health* 2019; **7**: e311 [PMID: 30784631 DOI: 10.1016/S2214-109X(18)30521-7]

133 **Sahara Reporters**. NDLEA Reveals Circulation Of New Illicit Drug In Nigeria, As Agency Nabs 4,838 Traffickers In First Half Of 2016. [cited 15 January 2022]. Available from: https://saharareporters.com/2016/10/06/ndlea-reveals-circulation-new-illicit-drug-nigeria-agency-nabs-4838-traffickers-first

134 **Loudoun NOW**. Dulles CBP Seizes Khat Load from Nigeria. Apr 2, 2020. [cited 15 January 2022]. Available from: https://www.loudounnow.com/2020/04/02/dulles-cbp-seizes-khat-load-from-nigeria/

135 **Soni P**, Siddiqui AA, Dwivedi J, Soni V. Pharmacological properties of Datura stramonium L. as a potential medicinal tree: an overview. *Asian Pac J Trop Biomed* 2012; **2**: 1002-1008 [PMID: 23593583 DOI: 10.1016/S2221-1691(13)60014-3]

136 **Adegoke SA**, Alo LA. Datura stramonium poisoning in children. *Niger J Clin Pract* 2013; **16**: 116-118 [PMID: 23377485 DOI: 10.4103/1119-3077.106783]

137 **Symon DE**, Haegi L Datura (Solanaceae) is a new world genus. In: Hawkes JG, Lester RN, Nee M, Estrada N. Solanaceae III: taxonomy, chemistry, evolution. London: Royal Botanic Gardens Kew, 1991: 197-210

138 **Luna-Cavazos M**, Bye R, Jiao M. The origin of Datura metel (Solanaceae): genetic and phylogenetic evidence. *Genet Resour Crop Evol* 2009; **56**: 263-275 [DOI: 10.1007/s10722-008-9363-5]

139 **Kerchner A**, Farkas Á. Worldwide poisoning potential of Brugmansia and Datura. *Forensic Toxicol* 2020; **38**: 30-41 [DOI: 10.1007/s11419-019-00500-2]

140 **Castroviejo S**, Aedo C, Laínz M, Muñoz Garmendia F, Nieto Feliner G, Paiva J, Benedí C. Flora iberica. Vol. 11. Gentianaceae-Boraginaceae. Madrid: Real Jardín Botánico, CSIC, 2012: 216-222

141 **Gupta PK**. Drugs of use, dependence, and abuse. In: Illustrated Toxicology. London: Academic Press, 2018: 331-356

142 **Marc B**, Martis A, Moreau C, Arlie G, Kintz P, Leclerc J. Intoxications aiguës à Datura stramonium aux urgences [Acute Datura stramonium poisoning in an emergency department]. *Presse Med* 2007; **36**: 1399-1403 [PMID: 17560071 DOI: 10.1016/j.lpm.2007.04.017]

143 **Wiebe TH**, Sigurdson ES, Katz LY. Angel's Trumpet (Datura stramonium) poisoning and delirium in adolescents in Winnipeg, Manitoba: Summer 2006. *Paediatr Child Health* 2008; **13**: 193-196 [PMID: 19252697 DOI: 10.1093/pch/13.3.193]

144 **Trancă SD**, Szabo R, Cociș M. Acute poisoning due to ingestion of Datura stramonium - a case report. *Rom J Anaesth Intensive Care* 2017; **24**: 65-68 [PMID: 28913501 DOI: 10.21454/rjaic.7518.241.szb]

145 **Babalola SA**. Datura Metel L: Analgesic or Hallucinogen? *MEJSR* 2014 [DOI: 10.5829/idosi.mejsr.2014.21.06.21554]

146 **Imo C**, Arowora KA, Ezeonu CS, Yakubu OE, Nwokwu CD, Azubuike NC, Sallah YG. Effects of ethanolic extracts of leaf, seed and fruit of Datura metel L. on kidney function of male albino rats. *J Tradit Complement Med* 2018; **9**: 271-277 [PMID: 31453122 DOI: 10.1016/j.jtcme.2017.09.001]

147 **Al-Snafi AE**. Medical importance of Datura fastuosa (syn: Datura metel) and Datura stramonium - A review. *IOSR J Pharmacy* 2017; **7**: 43-58 [DOI: 10.9790/3013-0702014358]

148 **Kuete V**. Physical, Hematological, and Histopathological Signs of Toxicity Induced by African Medicinal Plants. In: Kuete V. Toxicological Survey of African Medicinal Plants. New York: Elsevier, 2014: 635-657

149 **Ujváry I**. Psychoactive natural products: overview of recent developments. *Ann Ist Super Sanita* 2014; **50**: 12-27 [PMID: 24695249 DOI: 10.4415/ANN_14_01_04]

150 **Schifano F**, Orsolini L, Duccio Papanti G, Corkery JM. Novel psychoactive substances of interest for psychiatry. *World Psychiatry* 2015; **14**: 15-26 [PMID: 25655145 DOI: 10.1002/wps.20174]

151 **Zanda MT**, Fattore L. Novel Psychoactive Substances: A New Behavioral and Mental Health Threat. In: Watson RR, Zibadi S. Addictive Substances and Neurological Disease. New York: Academic Press, 2017: 341-353

152 **152 Glick SD**, Maisonneuve IM. Development of novel medications for drug addiction. The legacy of an African shrub. *Ann N Y Acad Sci* 2000; **909**: 88-103 [PMID: 10911925 DOI: 10.1111/j.1749-6632.2000.tb06677.x]

153 **Iyer RN**, Favela D, Zhang G, Olson DE. The iboga enigma: the chemistry and neuropharmacology of iboga alkaloids and related analogs. *Nat Prod Rep* 2021; **38**: 307-329 [PMID: 32794540 DOI: 10.1039/d0np00033g]

154 **Gericke N**, Viljoen AM. Sceletium--a review update. *J Ethnopharmacol* 2008; **119**: 653-663 [PMID: 18761074 DOI: 10.1016/j.jep.2008.07.043]

155 **Manganyi MC**, Bezuidenhout CC, Regnier T, Ateba CN. A Chewable Cure "Kanna": Biological and Pharmaceutical Properties of *Sceletium tortuosum*. *Molecules* 2021; **26** [PMID: 33924742 DOI: 10.3390/molecules26092557]

156 **De Luca MA**, Castelli MP, Loi B, Porcu A, Martorelli M, Miliano C, Kellett K, Davidson C, Stair JL, Schifano F, Di Chiara G. Native CB1 receptor affinity, intrinsic activity and accumbens shell dopamine stimulant properties of third generation SPICE/K2 cannabinoids: BB-22, 5F-PB-22, 5F-AKB-48 and STS-135. *Neuropharmacology* 2016; **105**: 630-638 [PMID: 26686391 DOI: 10.1016/j.neuropharm.2015.11.017]

157 **Sholler DJ**, Huestis MA, Amendolara B, Vandrey R, Cooper ZD. Therapeutic potential and safety considerations for the clinical use of synthetic cannabinoids. *Pharmacol Biochem Behav* 2020; **199**: 173059 [PMID: 33086126 DOI: 10.1016/j.pbb.2020.173059]

158 **Dresen S**, Ferreirós N, Pütz M, Westphal F, Zimmermann R, Auwärter V. Monitoring of herbal mixtures potentially containing synthetic cannabinoids as psychoactive compounds. *J Mass Spectrom* 2010; **45**: 1186-1194 [PMID: 20857386 DOI: 10.1002/jms.1811]

159 **Banister SD**, Stuart J, Kevin RC, Edington A, Longworth M, Wilkinson SM, Beinat C, Buchanan AS, Hibbs DE, Glass M, Connor M, McGregor IS, Kassiou M. Effects of bioisosteric fluorine in synthetic cannabinoid designer drugs JWH-018, AM-2201, UR-144, XLR-11, PB-22, 5F-PB-22, APICA, and STS-135. *ACS Chem Neurosci* 2015; **6**: 1445-1458 [PMID: 25921407 DOI: 10.1021/acschemneuro.5b00107]

160 Synthetic Marijuana Linked To Seizures, Psychosis And Death. Feb 7, 2017. [cited 15 January 2022]. Available from: https://www.cedargroup.org/cannabis/synthetic-marijuana-linked-to-seizures-psychosis-and-death/

161 **Diao X**, Huestis MA. Approaches, Challenges, and Advances in Metabolism of New Synthetic Cannabinoids and Identification of Optimal Urinary Marker Metabolites. *Clin Pharmacol Ther* 2017; **101**: 239-253 [PMID: 27727455 DOI: 10.1002/cpt.534]

162 **Tai S**, Fantegrossi WE. Pharmacological and Toxicological Effects of Synthetic Cannabinoids and Their Metabolites. *Curr Top Behav Neurosci* 2017; **32**: 249-262 [PMID: 28012093 DOI: 10.1007/7854_2016_60]

163 **Weinstein AM**, Rosca P, Fattore L, London ED. Synthetic Cathinone and Cannabinoid Designer Drugs Pose a Major Risk for Public Health. *Front Psychiatry* 2017; **8**: 156 [PMID: 28878698 DOI: 10.3389/fpsyt.2017.00156]

164 **Scourfield A**, Flick C, Ross J, Wood DM, Thurtle N, Stellmach D, Dargan PI. Synthetic cannabinoid availability on darknet drug markets-changes during 2016-2017. *Toxicol Commun* 2019; 7-15 [DOI: 10.1080/24734306.2018.1563739]

165 **Chelin R**. Drug trafficking synthetic drugs in the rise despite Mauritius best efforts. [cited 15 January 2022]. Available from: https://enactafrica.org/enact-observer/synthetic-drugs-on-the-rise-despite-mauritiuss-best-efforts

166 **Chelin R**. New Wiz drug targets South African youths. [cited 17 January 2022]. Available from: https://enactafrica.org/enact-observer/new-wiz-drug-targets-south-africas-youth

167 **Akande S**. A new deadly form of marijuana is slowly wreaking havoc in Nigeria's cities. Jul 24, 2017. [cited 17 January 2022]. Available from: https://www.pulse.ng/gist/synthetic-marijuana-black-mamba-a-new-deadly-form-of-marijuana-is-slowly-wreaking/r4dmxpn

168 **Cooper ZD**. Adverse Effects of Synthetic Cannabinoids: Management of Acute Toxicity and Withdrawal. *Curr Psychiatry Rep* 2016; **18**: 52 [PMID: 27074934 DOI: 10.1007/s11920-016-0694-1]

169 **Cohen K**, Weinstein AM. Synthetic and Non-synthetic Cannabinoid Drugs and Their Adverse Effects-A Review From Public Health Prospective. *Front Public Health* 2018; **6**: 162 [PMID: 29930934 DOI: 10.3389/fpubh.2018.00162]

170 Diagnostic and statistical manual of mental disorders (5th ed). Arlington: American Psychiatric Association, 2013

171 **Myers B**, Koch JR, Johnson K, Harker N. Factors associated with patient-reported experiences and outcomes of substance use disorder treatment in Cape Town, South Africa. *Addict Sci Clin Pract* 2022; **17**: 8 [PMID: 35109915 DOI: 10.1186/s13722-022-00289-3]

172 **Corazza O**, Roman-Urrestarazu A. Handbook of Novel Psychoactive substances: What Clinicians Should Know About NPS. New York: Routledge, 2019

173 **Harker Burnhams N**, Bharat C, Williams DR, Stein DJ, Myers B. Transitions between lifetime alcohol use, regular use and remission: Results from the 2004 South African Stress and Health Survey. *S Afr Med J* 2018; **109**: 40-46 [PMID: 30606303 DOI: 10.7196/SAMJ.2018.v109i1.13061]

174 **Rabie M**, Shaker NM, Gaber E, El-Habiby M, Ismail D, El-Gaafary M, Lotfy A, Sabry N, Khafagy W, Muscat R. Prevalence updates of substance use among Egyptian adolescents. *Middle East Curr Psychiatry* 2020; **27** [DOI: 10.1186/s43045-019-0013-8]

175 **United Nations**. Transforming our world: the 2030 agenda for sustainable development. Resolution of the United Nations General Assembly. [cited 17 January 2022]. Available from: https://sdgs.un.org/2030agenda

176 **Onifade PO**, Somoye EB, Ogunwobi OO, Ogunwale A, Akinhanmi AO, Adamson TA. A descriptive survey of types, spread and characteristics of substance abuse treatment centers in Nigeria. *Subst Abuse Treat Prev Policy* 2011; **6**: 25 [PMID: 21923946 DOI: 10.1186/1747-597X-6-25]

177 **Myers BJ**, Louw J, Pasche SC. Inequitable access to substance abuse treatment services in Cape Town, South Africa. *Subst Abuse Treat Prev Policy* 2010; **5**: 28 [PMID: 21073759 DOI: 10.1186/1747-597X-5-28]

178 **Charlson FJ**, Diminic S, Lund C, Degenhardt L, Whiteford HA. Mental and substance use disorders in Sub-Saharan Africa: predictions of epidemiological changes and mental health workforce requirements for the next 40 years. *PLoS One* 2014; **9**: e110208 [PMID: 25310010 DOI: 10.1371/journal.pone.0110208]

179 **Deressa W**, Azazh A. Substance use and its predictors among undergraduate medical students of Addis Ababa University in Ethiopia. *BMC Public Health* 2011; **11**: 660 [PMID: 21859483 DOI: 10.1186/1471-2458-11-660]

180 **Birhanu AM**, Bisetegn TA, Woldeyohannes SM. High prevalence of substance use and associated factors among high school adolescents in Woreta Town, Northwest Ethiopia: multi-domain factor analysis. *BMC Public Health* 2014; **14**: 1186 [PMID: 25410657 DOI: 10.1186/1471-2458-14-1186]

181 **Ogunsola OO**, Fatusi AO. Risk and protective factors for adolescent substance use: a comparative study of secondary school students in rural and urban areas of Osun State, Nigeria. *Int J Adolesc Med Health* 2016; **29** [PMID: 26824975 DOI: 10.1515/ijamh-2015-0096]

182 **Jere DL**, Norr KF, Bell CC, Corte C, Dancy BL, Kaponda CP, Levy JA. Substance Use and Risky Sexual Behaviors Among Young Men Working at a Rural Roadside Market in Malawi. *J Assoc Nurses AIDS Care* 2017; **28**: 250-265 [PMID: 26264258 DOI: 10.1016/j.jana.2015.07.003]

183 **Jumbe S**, Kamninga TM, Mwalwimba I, Kalu UG. Determinants of adolescent substance use in Africa: a systematic review and meta-analysis protocol. *Syst Rev* 2021; **10**: 125 [PMID: 33906677 DOI: 10.1186/s13643-021-01680-y]

184 **Seid L**, Gintamo B, Mekuria ZN, Hassen HS, Gizaw Z. Substance use and associated factors among preparatory school students in Kolfe-Keranyo sub-city of Addis Ababa, Ethiopia. *Environ Health Prev Med* 2021; **26**: 110 [PMID: 34798804 DOI: 10.1186/s12199-021-01032-1]

185 **Oshodi OY**, Aina OF, Onajole AT. Substance use among secondary school students in an urban setting in Nigeria: prevalence and associated factors. *Afr J Psychiatry (Johannesbg)* 2010; **13**: 52-57 [PMID: 20428599 DOI: 10.4314/ajpsy.v13i1.53430]

186 **Kiburi SK**, Molebatsi K, Obondo A, Kuria MW. Adverse childhood experiences among patients with substance use

disorders at a referral psychiatric hospital in Kenya. *BMC Psychiatry* 2018; **18**: 197 [PMID: 29914409 DOI: 10.1186/s12888-018-1780-1]

187 **Muchiri BW**, Dos Santos MML. Family management risk and protective factors for adolescent substance use in South Africa. *Subst Abuse Treat Prev Policy* 2018; **13**: 24 [PMID: 29914541 DOI: 10.1186/s13011-018-0163-4]

188 **Substance Abuse and Mental Health Services Administration**; Office of the Surgeon General. Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health [Internet]. Washington: US Department of Health and Human Services, 2016

Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
Telephone: +1-925-3991568
E-mail: bpgoffice@wjgnet.com
Help Desk: https://www.f6publishing.com/helpdesk
https://www.wjgnet.com