Xylazine: An Emerging New Psychoactive Substance among Drug Users in the Coast Region, Kenya

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Abstract

The world has witnessed an increase in the range of new psychoactive substances (NPS) available in the illicit drug market. Of concern is the emerging discovery of veterinary drugs as alternative psychoactive substances. Despite the emerging threat posed by NPS, especially those of veterinary nature, majority are not controlled substances. This study thus aimed at elucidating the occurrence of the emerging NPS in the Coast region, Kenya. A purposive sample of 33 IDUs (30 male and 13 female) were recruited into the study for identification of NPS and actual sample collection. A total of 21 samples of suspected NPS were collected and submitted for laboratory identification. Confirmatory results identified xylazine, ketamine, amitriptyline and diazepam as the NPS in the region. Analysis of adulterants in heroin samples confirmed the presence of caffeine; dextromethorphan; codeine; acetaminophen; metronindazole; chloroquine; and lidocaine. There was no evidence of xylazine as one of the adulterants. However, the emerging entry of veterinary drugs such as xylazine into the illicit drug market poses a major hindrance in reversing the gains realized in the field of harm reduction. The study therefore recommends consideration for scheduling xylazine and other veterinary drugs prone to human abuse. Further, there is an urgent need for the scientific community to provide an alternative antidote for the management of non-opioid drug-related overdose. Lastly, there is need for Kenya Veterinary Board to institute measures to regulate and control the diversion of xylazine and other veterinary drugs prone to human abuse.

Key words

New psychoactive substances (NPS), xylazine and veterinary drugs

Introduction

In 2020, an estimated 284 million people aged 15–64 had used a drug in the past 12 months. The number was 26 per cent higher than in 2010, partly because of the world population growth (UNODC, 2022). With the emergence of new psychoactive substances (NPS), the drug market has witnessed an increased number of intoxicated people presenting with emergencies after consumption of drugs with unknown health consequences or safety profiles. In addition, there is a growing concern of the unknown acute and long-term side effects of NPS including the limited safety data on their toxicity. Data also shows that from 2009 – 2017, a total of 803 NPS were

reported. Such a scenario poses additional difficulties for substance identification, control, and treatment approaches (Faltore and Weinstein, 2019). UNODC uses the term "new psychoactive substances (NPS)" which are defined as "substances of abuse, either in a pure form or a preparation, that are not controlled by the 1961 Single Convention on Narcotic Drugs or the 1971 Convention on Psychotropic Substances, but which may pose a public health threat". The term "new" does not necessarily refer to new inventions, rather substances that have recently entered the drug market (UNODC, 2021).

Recently, a number of countries reported an emerging trend with the growing "cross-over" of veterinary drugs indicated for sedation, anesthesia and analgesia for abuse by humans. One of the emerging veterinary drugs diverted as an alternative psychoactive substance for humans is xylazine. It has been shown that xylazine is slowly emerging into the illicit drugs market mostly in combination with fentanyl, heroin, or cocaine (Krishnan, 2022). Puerto Rico is the "seed country" for the widespread use of veterinary tranquilizer, xylazine (Gupta, Holtgrave and Ashburn, 2023). Xylazine drug use trend has now entered the illicit drug market in the United States (Johnson et al., 2021; Bowles et al., 2021) and recently Canada (Gupta, Holtgrave and Ashburn, 2023).

Despite the emerging threat posed by NPS, especially those of veterinary nature, majority are not controlled substances. Secondly, the pharmacodynamics and pharmacokinetics of these substances are not well understood making clinical response difficult. Lastly, the threat posed by NPS in the management of drug overdose poses another potential public health crisis. This study thus aimed at elucidating the occurrence of the emerging NPS in the Coast region, Kenya. The study was prompted by circulating social media images depicting "zombie-like" characteristics purportedly captured in the country's Coast region. The implementation of the study was through a collaborative approach with the team comprising of the National Authority for the Campaign Against Alcohol and Drug Abuse (NACADA); Ministry of Interior and National Coordination; Pharmacy and Poisons Board; Government Chemist; Reachout Centre Trust; MEWA; Teen's Watch; and Omari Project.

The findings of the study will inform early preparedness for any potential emerging threat of NPS in Kenya. Further, the data will inform preventive and control interventions including policy and legal framework review to respond to emerging challenges of NPS.

Methodology

The study used an exploratory cross-sectional design to understand the emerging NPS drug use trends in the Coast region of Kenya. The study population constituted the sub-group population of current injecting drug users (IDUs). The study area focused on Mombasa, Kilifi and Kwale counties.

The Coast region was sampled purposively due to the linkage of the circulating social media images of drug users depicting "zombie-like" characteristics. The 3 counties namely Mombasa, Kilifi and Kwale were also purposively selected having been mapped as key hotspots for drug use in the region. The study sites used for sample collection are shown in Table 1.

Table 1: Sample collection sites

Region	Sampled County	Sampled sites
Coast	Mombasa	Kisauni
		Bombolulu
		Mvita
	Kwale	Ukunda
		Kombani
	Kilifi	Malindi
		Kilifi Town

The study employed respondent driven sampling technique (RDS), a form of chain-referral network or snowball sampling. This method resolves the inherent problems associated with chain-referral sampling especially recruitment of initial participants, volunteerism and masking (Heckathorn, 2002). This method acknowledges that using peers in the recruitment of participants is effective towards reaching other members of the hidden population. Hidden populations are usually subject to social stigma, criminal prosecution and fear. A set of initial seeds of IDUs was selected using a pre-existing contact of service providers working with the drug users (DUs). The service providers were mainly peer educators working directly with IDUs. These initial IDUs expanded in waves, where wave 1 consisted of IDUs referred by the initial seeds. The second wave consisted of IDUs referred by those in the first wave. Although concerns of unknown bias into the sampling process exists for lack of randomization, evidence shows that respondents are recruited randomly by peers (Heckathorn, 2002). The recruited IDUs were enrolled as key informants in the collection of suspected samples of NPS available in their locality.

After consent was obtained from the IDUs a check-list was used to record names of the NPS that the DUs had encountered in the past six months. This included recording their street names. From the mentioned substances, the IDUs were facilitated to collect the suspected samples for laboratory testing and identification. A purposive sample of 33 IDUs (30 male and 13 female) were recruited into the study. Two (2) of the most knowledgeable IDUs on emerging psychoactive substances were purposively recruited in each of the 7 study sites for sample collection. Progressively, sample collection was limited to emerging substances that had not been collected in the previous drug collection sites. In addition, the IDUs were also facilitated to collect heroin samples for laboratory identification of the main adulterants.

The collected samples were received by the coordinating team for coding and labeling. Each sample was given a sample number; date of sampling; the county and sample collection site; method of sampling; and the name of the handling officer. Each suspected sample of NPS was also recorded according to its street names. After labeling, the samples were packaged and transported to the Government Chemist, which is the national reference laboratory, for testing and identification.

The study being exploratory in nature, the sample size was not pre-determined. However, any reported suspected samples of NPS making entry into the illicit drug market in the past six months were collected

for laboratory identification. The suspected samples of NPS collected during fieldwork were processed and screened using the UV-Visible Spectrophotometer (Shimadzu UV-VIS – 1650PC) and identity confirmed using Gas Chromatography linked with Mass Spectrometer detector (GC-MS, Agilent Model GC 7890B with a mass spectrometer 5977A MSD). GC-MS is one of the most commonly used techniques for the identification and quantification of suspected drug samples providing spectral data on individual compounds in a complex mixture with very high precision often without prior separation (Gill, Stead and Moffat, 1981; Rop et al., 1988). Suspected samples were also subjected to Fourier Transform Infrared (FTIR) Spectroscopy. FTIR is increasingly being preferred for rapid identification of psychoactive drugs (Liu, Yu and Min, 2019).

Descriptive statistics particularly frequencies and percentages were used to summarize and present the quantitative data generated from laboratory analysis of the suspected samples of NPS submitted for identification.

Results

Self-reported NPS in the Coast region

Analysis of the self-reported checklist of individual IDUs revealed the following emerging substances encountered in the past 6 months: xylazine, ketamine, amitriptyline, diazepam and methamphetamine (Table 2).

Table 2: Self-reported NPS in the Coast region

Sample No.	Street names
Xylazine	Tranq, tranquilizer
Ketamine	Ketamine
Amitriptyline	Red beret
Diazepam	Yellow, C5, C
Methamphetamine	Meth

Laboratory analysis and identification of NPS

From a total of 21 samples submitted for laboratory identification, confirmatory results revealed evidence of NPS especially xylazine, ketamine, amitriptyline and diazepam (Table 3).

Table 3: Results of laboratory analysis and identification of NPS

Sample No.	Confirmed drug	Sampled County
F/MISC/359/23	Heroin	Mombasa
F/MISC/360/23	Heroin	Mombasa
F/MISC/361/23	Heroin	Mombasa
F/MISC/362/23	Heroin	Mombasa
F/MISC/363/23	Heroin	Mombasa
F/MISC/364/23	Heroin	Mombasa
F/MISC/365/23	Heroin	Mombasa
F/MISC/366/2023	Ketamine	Mombasa
F/MISC/370/23	Heroin	Kwale
F/MISC/371/23	Heroin	Kwale
F/MISC/372/23	Heroin	Kwale
F/MISC/373/23	Heroin	Kwale
F/MISC/377/23	Heroin	Kwale
F/MISC/378/23	Heroin	Kwale
F/MISC/379/23	Heroin	Kwale
F/MISC/374/23	Cannabis	Mombasa
F/MISC/375/23	Amitriptyline	Mombasa
F/MISC/376/23	Diazepam	Mombasa
F/MISC/367/23	Xylazine	Mombasa
F/MISC/368/23	Ketamine	Mombasa
F/MISC/369/23	Amitriptyline	Mombasa

Analysis and identification of adulterants in heroin samples

Collection of heroin samples was critical in the analysis and identification of adulterants to establish any emerging trends. A total of 14 heroin samples were confirmed through laboratory identification (Table 4).

Table 4: Results of laboratory analysis and identification of adulterants in heroin samples

Sample No.	Confirmed drug
F/MISC/359/23	Heroin
F/MISC/360/23	Heroin
F/MISC/361/23	Heroin
F/MISC/362/23	Heroin
F/MISC/363/23	Heroin
F/MISC/364/23	Heroin
F/MISC/365/23	Heroin

Sample No.	Confirmed drug
F/MISC/370/23	Heroin
F/MISC/371/23	Heroin
F/MISC/372/23	Heroin
F/MISC/373/23	Heroin
F/MISC/377/23	Heroin
F/MISC/378/23	Heroin
F/MISC/379/23	Heroin

Table 5 outlines the profile of adulterants confirmed through laboratory identification. From the 14 confirmed heroin samples, 100% of them were adulterated with caffeine, 92.9% dextromethorphan, 78.6% codeine, 35.7% acetaminophen, 21.4% metronindazole, 14.3% chloroquine and 7.1% lidocaine. However, the study could not establish adulteration of heroin with xylazine.

Table 5: Summary of adulterants identified in heroin samples

Heroin Adulterant	Number (n)	Proportion (%) of total samples
Caffeine	14	100
Dextromethorphan	13	92.9
Codeine	11	78.6
Acetaminophen	5	35.7
Metronindazole	3	21.4
Chloroquine	2	14.3
Lidocaine	1	7.1

Discussion

The study findings revealed that xylazine, ketamine, amitriptyline and diazepam were the NPS emerging in the Coast region of Kenya. However, of concern was the discovery of xylazine, a veterinary tranquilizer. The study established that its availability was localized around Mombasa County. It has been documented that xylazine may be used alone or in combination with other anesthetic medications, such as ketamine (Drug Enforcement Administration (DEA), 2022; Krishnan, 2022). Xylazine is available mostly as a liquid and sometimes as a powder. The mode of administration of xylazine is either inhalation, oral or intravenous (IV) injection which is the most preferred route (Reyes et al., 2012). Xylazine has toxic effects in humans, who may also develop dependency (Ball et al., 2022).

Therefore, the entry of xylazine into the illicit drug market predisposes the DUs to unknown health consequences of veterinary products indicated for animal use. This emerging trend of DUs crossing over to veterinary drugs meant for animal sedation, anesthesia and analgesia has the potential to roll back the harm reduction gains achieved over the years. The growing use of xylazine has also been reported in Puerto Rico (Gupta, Holtgrave and Ashburn, 2023), United States (Johnson et al., 2021; Bowles

et al., 2021) and recently Canada (Gupta, Holtgrave and Ashburn, 2023). Most studies attempting to understand this emerging trend of xylazine use are premised on individual experiences of DUs. For example, a street drug user in Philadelphia reported that the main motivation of using xylazine was to potentiate the psychoactive effects of fentanyl (Friedman et al., 2022). It has also been shown that xylazine is commonly used as a polydrug mainly with heroin, cocaine or fentanyl (Krishnan, 2022). For instance, a drug user in Puerto Rico reported that heroin was only available pre-mixed with xylazine (Torruella, 2011). Other dealers were combining xylazine with cocaine in a drug blend known as a "speedball" (Toruella, 2011). The emerging entry of xylazine into the illicit drug market thus invites international discourse to re-look at the potential harm posed by diversion of veterinary drugs for psychoactive uses in humans considering that majority of these substances are not scheduled under the three International Drug Conventions: The Single Convention on Narcotic Drugs (1961); The Convention on Psychotropic Substances (1971); and The Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (1988) (United Nations, 1961; United Nations, 1971; United Nations, 1988). Likewise, nationally these substances are not controlled under the Naroctic Drugs and Psychotropic Substances Control Act, 1994 (GOK, 1994).

To understand the risks of adulteration of heroin with xylazine, the study collected heroin samples concurrently with the NPS. Laboratory results showed that the common adulterants for heroin were caffeine; dextromethorphan; codeine; acetaminophen; metronindazole; chloroquine; and lidocaine. The continued declining potency of heroin available in the market due to the increasing adulteration may be one of the motivating factors for IDUs to explore veterinary drugs alternatives. Others studies have identified similar adulterants especially caffeine, acetaminophen, dextromethorphan and acetyl codeine (Chandra et al., 2022; Bourmaud et al., 2021). However, lidocaine as an adulterant is commonly reported from samples of cocaine (Bourmaud et al., 2021). The findings showed that there was no evidence of pre-adulteration of heroin samples with xylazine. However, the study could not establish the circumstances around the actual injecting where polydrug use of xylazine and heroin was likely to be detected.

Conversely, xylazine is progressively being detected as an adulterant in numerous street drugs (Alexander et al., 2022). A study in Puerto Rico found out that 37.6% of all discarded syringes contained some traces of xylazine, including another 90.6% of speedball syringes (Rodriguez et al., 2008). Xylazine is now detected in street drug supplies in the United States. A study in Philadelphia reported the presence of xylazine in overdose deaths resulting from heroin and/or fentanyl. These overdose deaths rose from 2% of cases in 2014 to 31% of cases in 2019 (Johnson et al., 2021). A Canadian study from a drug detection service in Toronto established that xylazine was first detected in September 2020 in the Toronto area, but in 2021, 7.2% of fentanyl samples and 12.5% of methamphetamine samples also contained xylazine (Bowles et al., 2021). Drug overdose mortality statistics from the U.S. Census revealed that xylazine was found in 0.36% of such deaths in 2015 and rose to 6.7% in 2020 (D'Arrigo, 2022).

From the study findings, the discovery of xylazine in the illicit drug market has direct implications for harm reduction programs targeting DUs especially overdose management. Studies have shown that

xylazine is linked to considerable morbidity and mortality. Even the lethal dose in humans remains unknown with some reports showing deaths linked to trace amounts of xylazine (DEA, 2022). This evolving evidence of xylazine induced mortality equally suggests an increased risk for drug overdose burden. However, there are no existing protocols for managing xylazine overdose or withdrawal (Ehrman-Dupre et al., 2022; Thangada et al., 2021). Available evidence also shows that xylazine is not sensitive to overdose reversal drugs naloxone or nalmefene (Nunez, DeJoseph and Gill, 2022; D'Arrigo, 2022). This could be explained by the fact that xylazine is a non-opioid that is not sensitive to opioid overdose medication naloxone and nalmefene.

Conclusion

The detection of veterinary drugs such as xylazine in the illicit drug market buttresses the need for continuous surveillance for emerging drug use trends to avert reversal of harm reduction gains realized over the years. Whereas management of opioid related overdose has yielded impressive outcomes with the use of naloxone and nalmefene treatments, the entry of veterinary drugs that are non-opioid in nature poses a potential public health crisis. Hence, with the continued proliferation of xylazine in the illicit drug markets, the burden of overdose related mortality may record a sharp increase before the discovery of an alternative non-opioid antidote.

Then again, xylazine is not scheduled internationally under the three UN drug conventions or nationally under the Naroctic Drugs and Psychotropic Substances Control Act, 1994. Lack of a regulatory framework for handling xylazine hinders any enforcements efforts to control its diversion into the illicit drug market. The study therefore recommends consideration for scheduling xylazine and other veterinary drugs prone to human abuse. Also, there is an urgent need for the scientific community to provide an alternative antidote for the management of non-opioid drug-related overdose. Lastly, there is need for Kenya Veterinary Board to institute measures to regulate and control the diversion of xylazine and other veterinary drugs prone to human abuse.

Nonetheless, further research is needed to understand the emerging gaps on the underlying motivational factors for xylazine use among DUs. In addition, used syringe analysis may confirm any existing risks for xylazine-linked polydrug use.

Limitations of the study

The scope of the study was limited to the Coast region in the counties of Mombasa, Kilifi and Kwale. Secondly, given that the study adopted an exploratory design, the generalizability of the findings may not be guaranteed. Finally, though the study was limited to collection of suspected samples of NPS, complementary urine drug testing could have augmented the laboratory findings.

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