REPUBLIC OF KENYA

NACADA
FOR A NATION FREE FROM ALCOHOL AND DRUG ABUSE

Wastewater Analysis

To Assess Emerging New Psychoactive Substances and Illicit Drug Use In Kenya

APRIL 2026

FOREWORD

This study is dedicated to identifying and analyzing emerging drug use trends, with a focus on the evolving patterns of illicit drug consumption, the rise of new psychoactive substances (NPS), and the role of adulterants and cutting agents in substances such as heroin and cocaine.

The report provides a concise, evidence-based overview of current developments and societal implications of emerging drug use trends. By shedding light on these complex issues, the report seeks to advocate for the development of targeted prevention and control intervention strategies, fostering a proactive response to the dynamic challenges of the rapidly changing drug use trends in our communities.

This report also underscores the importance of wastewater analysis (WWA) in the surveillance of emerging drug use trends to inform public health strategies, guiding policy development, and enabling timely detection and response measures. By analyzing wastewater for drug residues, metabolites, and adulterants, this approach provides objective, population-level insights into the existence and spread of emerging psychoactive substances, including NPS and cutting agents of commonly used drugs.

The report emphasizes the need for establishing an early warning system to monitor emerging drug use trends and the proliferation of NPS. As illicit drug markets evolve rapidly, driven by innovations in synthetic drug production, globalized distribution networks, and shifting societal dynamics, the ability to detect and respond to new substances and consumption patterns is critical. The rise of NPS, often coupled with unpredictable adulterants in drugs like heroin and cocaine, poses significant challenges to public health, law enforcement, and policy frameworks.

Therefore, as global drug markets rapidly adapt to social, technological, and economic changes, understanding emerging drug use trends is essential for anticipating their impact on public health, safety, and policy.

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ABBREVIATIONS AND ACRONYMS

a-ET	Alpha-Ethyltryptamine
AMI	Amitriptyline
BSTFA	N,O-Bis(trimethylsilyl)trifluoroacetamide
CBD	Central Business District
CDC	Centres for Disease Control and Prevention
CNS	Central Nervous System
DMT	N, N-Dimethyltryptamine
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
EWS	Early Warning System
FGDs	Focus Group Discussions
GC – MS	Gas Chromatography – Mass Spectrometry
HIV	Human Immunodeficiency Virus
LSD	Lysergic Acid Diethylamide
MDMA	3, 4-methylenedioxymethamphetamine
NACADA	National Authority for the Campaign Against Alcohol and Drug Abuse
NIST	National Institute of Standards and Technology
NPS	New Psychoactive Substances
UN	United Nations
UNODC	United Nations Office on Drugs and Crime
WBE	Wastewater-Based Epidemiology
WHO	World Health Organization
WWA	Wastewater Analysis

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EXECUTIVE SUMMARY

Statistics from United Nations Office on Drugs and Crime (UNODC), indicate sustained growth, particularly in synthetic drugs like opioids and stimulants, while traditional plant-based drugs like opium face supply disruptions.

The emergence of new psychoactive substances (NPS) has accelerated since the early 2000s, driven by globalization, online markets, and simple synthetic chemistry, leading to over 1,000 substances reported globally by monitoring bodies like the UNODC and the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA).

To understand the emerging drug use trends, NACADA commissioned a study on wastewater analysis (WWA) to assess NPS and illicit drug use in Kenya. The study covered all the eight (8) regions of Kenya where suspected samples were collected for analysis. A total of 152 samples were collected and submitted to the Government Chemist for laboratory analysis and identification.

Analysis showed that cannabis, heroin and cocaine were the commonly used illicit drugs in Kenya. Results also confirmed that diazepam, trihexyphenidyl (artane), amitriptyline and tramadol were the most commonly abused prescription drugs.

Analysis also confirmed the existence of three (3) NPS namely alpha-ethyltryptamine, benzofurans and synthetic cathinones. The study also identified methamphetamine, MDMA (ecstasy) and tryptamine-based psychedelics (psilocybine and DMT) as other emerging psychoactive substances.

The study also revealed evidence of small scale clandestine laboratory activity related to illicit drug production of synthetic stimulants especially methamphetamine, MDMA and synthetic cathinones.

Results on surveillance of adulterants or cutting agents for the commonly used illicit drugs showed that caffeine, dextromethorphan, chloroquine and diazepam were the commonly used adulterants or cutting agents for heroin samples while levamisole, dextromethorphan, racemethorphan, caffeine and ketamine were the commonly used adulterants or cutting agents for cocaine samples.

According to the findings, there was evidence of emerging drug use trends including NPS. Therefore, in view of these evolving outcomes, the study proposes the following recommendations:

a) NACADA in collaboration with the relevant stakeholders to establish a National Wastewater Drug Surveillance and Early Warning System (EWS) to inform timely and coordinated response to mitigate emerging threats of NPS;

b) The Ministry of Interior and National Coordination to strengthen the Government Chemist, the national forensic laboratory with equipment and detection capabilities of emerging NPS;

c) The relevant enforcement agencies to adopt intelligence-led surveillance to identify and dismantle clandestine laboratories to curb illicit drug production and disruption of illicit drug supply chains. This includes monitoring and controlling the diversion of precursor chemicals used in the illicit manufacture of synthetic drugs and other emerging NPS;

d) The Ministry of Health in collaboration with the Government Chemist and NACADA to undertake continuous monitoring of adulterants and cutting agents in addition to establishment of an Adulterant Alert System to mitigate potential risks related to drug overdose;

e) The Ministry of Health to review the national treatment guidelines to provide for transition from single-substance treatment to integrated poly-drug management models;

f) The Pharmacy and Poisons Board to strengthen the pharmaceutical regulation and prescription monitoring to mitigate diversion and misuse of these drugs as emerging legal “highs”;

g) NACADA in collaboration with the county governments to undertake regular and sustained public education and awareness on the effects and risks of emerging drugs and NPS including targeted deployment of prevention campaigns in universities and nightlife settings;

h) Regular scheduling of emerging drugs and NPS to restrict their illegal production, distribution, possession and their availability on the market including review of the current scheduling framework to provide for rapid control of NPS; and

i) NACADA to strengthen the National Drug Observatory to integrate wastewater analysis, forensic, hospital and treatment data to inform timely response;

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CHAPTER ONE: INTRODUCTION

1.1 Background

Drug use continues to increase worldwide. In 2023, the global number of people who used a drug in the past year was estimated at 316 million people, or 6 per cent of the global population aged between 15 and 64. Representing an increase from the estimated 246 million people who used a drug in 2013, this is partially a result of population growth but also reflects an increase in the prevalence of drug use, which increased from 5.2 per cent in 2013 to 6.0 per cent in 2023 (UNODC, 2025).

Used by an estimated 244 million people (4.6 per cent) in 2023, cannabis remains the most used drug, followed by opioids, including synthetic opioids and natural opiates (61 million, or 1.2 per cent), amphetamines (31 million, or 0.6 per cent), cocaine (25 million, or 0.5 per cent) and ―ecstasy‖ (21 million, or 0.4 per cent). The number of people who use cannabis has grown by one third over the past decade, with the drug's prevalence of use increasing from an estimated 3.9 per cent in 2013 to 4.6 per cent in 2023 (2.3 per cent among women, 7.0 per cent among men) (UNODC, 2025).

The synthetic drug market continues to expand globally, aided by the fact that synthetic drugs can often be produced closer to destination markets than other types of drugs, which offers criminals advantages such as lower operational costs, few impediments to production and the reduced risk of detection, interdiction and prosecution. Methamphetamine and amphetamine continued to dominate the use of and trafficking in synthetic drugs worldwide in 2023 (UNODC, 2025).

1.2 Wastewater analysis

The foundation of wastewater analysis (WWA) or wastewater-based epidemiology (WBE) is that there are traces of everything we consume (whether metabolites or parent compounds) present in our waste. This ends up in the sewage network and can be utilized to show a fingerprint of consumed substances. The collection of samples from wastewater treatment plants is an important step in the overall process of WWA; a wealth of information regarding drug residue concentrations and local population concentration rates can be extrapolated and be applied to current substance abuse investigations in the area. WWA ultimately focuses on estimating the drug load and consumption of a specific substance based on presence and concentration, in order to confirm pre-existing evidence of target substances for the population/ environment of interest (Castiglioni et al., 2014; Thai et al., 2016).

This study on WWA is the first of a kind in Kenya and provides an integral toolkit for surveillance and identification of NPS together with tracking of emerging drug use trends. This study was conducted in collaboration with the Government Chemist, Pharmacy and Poisons Board, Nairobi City Water and Sewerage

Company Limited, Kisumu Water and Sanitation Company Limited, Eldoret Water and Sanitation Company, Nakuru Water and Sanitation Services Company and Mombasa Water Supply and Sanitation Company.

1.3 Rationale

NACADA Act 2012 mandates the Authority to collaborate with other lead agencies to facilitate and promote the monitoring and surveillance of national and international emerging trends and patterns in the production, manufacture, sale, consumption, trafficking and promotion of alcohol and drugs prone to abuse. This mandate underpins the need for regular surveillance to assess emerging drug use trends and patterns in the country using multiple methods e.g. WWA.

WWA has demonstrated its potential as a useful complement to established surveillance and monitoring tools in the drugs arena (Zuccato et al., 2008). This tool has the potential to provide timely information in short timeframes on geographical and temporal trends. Its rapid ability to detect new trends can help target public health programmes and policy initiatives at specific groups of people and the different drugs they are using. WWA is uniquely suited to identify NPS and shifts in drug use patterns quickly. The rapid emergence of NPS, with over 1,000 compounds reported by 2023, challenges traditional surveillance (European Monitoring Centre for Drugs and Drug Addiction, 2023). WWA captures data from entire communities, providing a more comprehensive picture than individual testing (González-Mariño et al., 2020). For NPS and illicit drugs, this is critical as users may not disclose use of emerging or stigmatized substances (Peacock et al., 2019).

1.4 Objectives

General objective

To assess the emerging new psychoactive substances (NPS) and illicit drug use in Kenya

Specific objectives

a. To collect and analyze wastewater samples for laboratory identification;
b. To collect and analyze suspected drug samples for laboratory identification;
c. To establish adulterants and cutting agents in heroin and cocaine samples;
d. To document emerging drug use trends in Kenya;

1.5 Limitations of the study

WWA offers critical complementary data source for monitoring NPS and illicit drug use. However, this method may be prone to the risk of missing the parent

compounds or metabolites due to their low concentrations in wastewater samples. WWA is also limited with data that may inform purity levels of illicit and synthetic drugs. To minimize these limitations inherent with WWA, this study incorporated collection of suspected drug samples from active users. In addition, sampling ensured that the identified wastewater sampling points were closest to the identified drug hotspots e.g. drug dens and entertainment venues.

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CHAPTER TWO: LITERATURE REVIEW

2.1 Global, regional and national drug use trends and patterns

As of 2025, global drug use continues to expand, driven by increased availability, diversification of synthetic substances, and evolving markets. According to the UNODC, an estimated 292 million people aged 15-64 used drugs in 2022, marking a 20% rise over the past decade (UNODC, 2024). Statistics from UNODC indicate sustained growth, particularly in synthetic drugs like opioids and stimulants, while traditional plantbased drugs like opium face supply disruptions (UNODC, 2025).

The World Health Organization (WHO) reports over 3 million annual deaths linked to alcohol and illicit drug use, with men accounting for approximately 80% of drugattributable fatalities (WHO, 2024). Key drivers include globalization of trafficking routes, the rise of online markets, and socioeconomic factors such as poverty, conflict, and climate change, which exacerbate vulnerabilities in regions like Africa and South-East Asia (UNODC, 2024). Treatment access remains critically low: only 1 in 11 people with drug use disorders receives care, with women facing greater barriers (1 in 18 vs. 1 in 7 for men) (UNODC, 2024).

As of September 2025, drug use in Africa is undergoing significant transformation, shifting from traditional cannabis use to a growing prevalence of synthetic drugs, cocaine, heroin, and pharmaceutical opioids. The World Drug Report 2025 estimates that Africa, with over 60% of its population under 25, contributes significantly to the global figure of 292 million drug users in 2022, with a regional past-year prevalence of 5.5% among those aged 15-64, notably higher in West and Central Africa (UNODC, 2025a). Key drivers include Africa's role as a major transit hub for drugs like cocaine, with 126.4 tons seized in West Africa from 2019-2024, fueling local consumption (UNODC, 2024c). Socioeconomic challenges, conflict, and climate-driven displacement further exacerbate vulnerabilities (UNODC, 2025b). Treatment access is critically low, with only 31% of youth under 25 receiving care despite high demand (UNODC, 2024b). The World Health Organization (WHO) notes that injecting drug use heightens HIV and hepatitis risks, with 3% of female HIV cases globally linked to injection, a trend evident in Africa (WHO, n.d.).

Kenya serves as a key East African transit point for heroin (from Afghanistan via Indian Ocean) and cocaine (from South America), with Mombasa port being central. UNODC reports rising seizures, indicating spillover to local markets (UNODC, 2025). Synthetic production is minimal, but diversion of pharmaceuticals and imports of methamphetamine fuel affordability.

2.2 New psychoactive substances (NPS)

NPS are defined as substances of abuse, either in pure form or as preparations, that are not controlled under the 1961 Single Convention on Narcotic Drugs or the 1971 Convention on Psychotropic Substances, but which may pose significant public health threats comparable to scheduled drugs (United Nations Office on Drugs and Crime [UNODC], 2024). These substances often referred to as "designer drugs," "legal highs," or "bath salts," are typically synthetic compounds designed to mimic the effects of traditional illicit drugs by modifying their chemical structures to evade legal controls (UNODC, 2024). The emergence of NPS has accelerated since the early 2000s, driven by globalization, online markets, and simple synthetic chemistry, leading to over 1,000 substances reported globally by monitoring bodies like the UNODC and the EMCDDA (UNODC, 2024).

Most of the NPS reported to be in the global drug market in the past five years were synthetic cannabinoids, followed by synthetic cathinones and phenethylamines. On the basis of seizure data, trafficking in synthetic NPS cannabinoids seems to have increased in 2023, although ketamine continues to dominate synthetic NPS seizures globally (UNODC, 2025).

In 2023, 41 countries reported seizures of synthetic NPS, and Asia continued to account for the largest quantities of NPS seized. In 2023, a significant quantity of synthetic NPS was seized in Africa for the first time. Most notably, a substantial quantity of —kush (which contains unknown quantities of various synthetic cannabinoids and other drugs) was reportedly seized in Sierra Leone and just over 1 ton of ketamine was seized in Kenya. Trafficking in plant-based NPS remains more geographically concentrated than that of synthetic NPS, as 19 countries reported seizures of plant-based NPS in 2023. Of those plant-based NPS, trafficking in khat and kratom is the most prevalent (UNODC, 2025).

NPS pose severe health risks, including cardiovascular, neurological, and psychiatric effects, often amplified by poly-drug use (UNODC, 2024). Synthetic cannabinoid receptor agonists can cause euphoria, memory impairment, psychosis, and cardiotoxicity; stimulants lead to neurotoxicity, hyperthermia, and fatalities; opioids induce respiratory depression with high potency (e.g., nitazenes 70-500 times morphine's strength); sedatives/ hypnotics risk dependence and overdose; and dissociatives produce detachment, amnesia, and aggression (UNODC, 2024). During the COVID-19 pandemic (January 2020–March 2022), 215 NPS exposures were reported, with synthetic opioids dominating (114 cases, mostly fatalities involving fentanyl and analogues like brorphine and isotonitazene) (Lo Faro et al., 2023).

Synthetic cannabinoids (e.g., 4F-MDMB-BICA) and cathinones (e.g., 3-CMC) also contributed significantly, often in solitude-use scenarios amid isolation stress (Lo

Faro et al., 2023). Designer benzodiazepines like flualprazolam frequently co-occurred with opioids, heightening overdose risks (Lo Faro et al., 2023).

2.3 Wastewater analysis (WWA)

WWA or WBE is a scientifically validated method for monitoring illicit drug use by analyzing drug residues and metabolites in untreated sewage, providing objective, nearreal-time, population-level data (Causanilles et al., 2023). Since its conceptualization in 2001 and first applications in the mid-2000s, WWA has been implemented in over 100 cities worldwide, tracking substances such as cocaine, methamphetamine, MDMA, amphetamine, cannabis, and NPS (Gonzalez-Marino et al., 2020). With global drug use affecting an estimated 292 million people in 2022, WWA offers significant opportunities for public health, policy-making, and law enforcement to address the rising challenges of illicit drug consumption, as highlighted by the UNODC (UNODC, 2025).

Recent developments in WWA reveal increasing uptake and recognition of its potential in monitoring and surveillance of emerging drug use trends. In 2024, Taiwan's WWA study monitored 31 drugs, including 5 NPS, using sewer-network analysis to identify hotspots post-COVID (Lin et al., 2024). The UK's WWA program expanded to 50 sites, adding nitazenes and gabapentin, with results due in 2025 (Home Office, 2025).

2.4 Adulterants and cutting agents

Illicit drugs are frequently adulterated or "cut" during production, importation, or streetlevel distribution to increase volume, enhance profitability, or mimic/ enhance its pharmacological effects (Broseus et al., 2016). Cutting agents are categorized into diluents (inert substances adding bulk, e.g., sugars) and adulterants (pharmacologically active substances, e.g., stimulants or other opioids) (Coomber, 1997). This practice introduces variability in purity and composition, exacerbating public health risks, including overdose and toxicity (Ciccarone, 2017).

2.4.1 Common adulterants/ cutting agents for heroin

Heroin is a semi-synthetic opioid derived from morphine. Heroin cutting, driven by economics and supply factors, has shifted from inert diluents to potent adulterants like fentanyl, escalating public health risks (UNODC, 2023). Forensic and drug seizure analyses identify diverse cutting agents, with compositions varying by region and era (Broseus et al., 2016; UNODC, 2023).

Caffeine: Prevalent in 21-92% of samples and it lowers heroin's vaporization temperature for smoking and counteracts sedation (Coomber, 1997; Broseus et al., 2016).

Acetaminophen: Detected in up to 91% of samples and is valued for analgesia and similar melting point to heroin (Schneider & Meys, 2011).

Local anesthetics (e.g., lidocaine, procaine, prilocaine): Found in 0.7- 47% of samples and they mimic heroin's numbing "rush" (Broseus et al., 2016).

Quinine: Present in 68% of white heroin samples in the US and it replicates heroin's bitter taste and respiratory stimulation (DEA, 1980).

Fentanyl and analogues (e.g., carfentanil): Increasingly dominant in North America; 62% of opioid samples (including heroin) contained fentanyl in Canada (2020), with carfentanil in 14% (Health Canada, 2020). These amplify opioid effects but increase overdose risk (Ciccarone, 2017).
Levamisole (more common in cocaine, up to 80% in US seizures by 2009) appears in heroin, adding bulk and mild stimulation via aminorex (Valdez et al., 2010).

Phenacetin and non-opioid analgesics (8% of samples) mimic pain relief (Broseus et al., 2016).

Other hazardous additions include strychnine, rat poison, and laundry detergent (UNODC, 2023).

2.4.2 Common adulterants/ cutting agents for cocaine

Cocaine, a potent stimulant derived from the coca plant. Cocaine adulteration, driven by economic and market factors, has shifted from simple diluents to complex mixtures of pharmacologically active substances like levamisole and fentanyl, posing significant public health challenges (UNODC, 2023).

Forensic analyses of cocaine seizures reveal a wide range of cutting agents, with compositions varying by region, market dynamics, and trafficking stage (Broseus et al., 2016; UNODC, 2023). Adulterants are introduced to mimic or potentiate cocaine's effects, enhance delivery (e.g., smoking), or reduce production costs (Coomber, 1997).

Levamisole: A veterinary antihelminthic, levamisole is one of the most prevalent cocaine adulterants, detected in up to 80% of US seizures by 2009 (Valdez et al., 2010). It adds bulk, enhances perceived potency via its metabolite aminorex (a stimulant), and is inexpensive. Its use peaked in the 2000s but remains significant (UNODC, 2023).

Local anesthetics (e.g., lidocaine, procaine, tetracaine, benzocaine): Found in 10-70% of samples, these mimic cocaine's numbing effect, enhancing perceived quality (Broseus et al., 2016). Lidocaine was reported in 47% of European samples (20102015) (EMCDDA, 2016).

Caffeine: Detected in 30-60% of samples, caffeine potentiates cocaine's stimulant effects and is cost-effective (Coomber, 1997). It was found in 55% of UK samples (2010) (Cole et al., 2010).

Phenacetin: A banned analgesic, phenacetin is common (10-30% of samples), valued for its pain-relieving properties and similarity to cocaine in appearance (Broseus et al., 2016).

Stimulants (e.g., amphetamines, ephedrine, methamphetamine): Less common (1-10% of samples), these amplify cocaine's effects but increase cardiovascular risks (UNODC, 2023).

Fentanyl and analogues: Increasingly detected in cocaine, especially in North America, fentanyl was found in 7% of cocaine-related deaths in Canada (2020) (Health Canada, 2020). This cross-contamination heightens overdose risk, particularly for opioid-naïve users.

Other agents: Less frequent but hazardous adulterants include diltiazem (a calcium channel blocker, 5-10% of samples), hydroxyzine (an antihistamine), and atropine (Cole et al., 2010). Contaminants like laundry detergent, boric acid, or veterinary drugs are occasionally reported (UNODC, 2023).

2.4.3 Health risks and clinical outcomes of adulterants

Toxicity from adulterants: Levamisole is linked to agranulocytosis (low white blood cell count) and vasculitis in 5-20% of exposed users, causing severe skin lesions and immune suppression (Valdez et al., 2010). Phenacetin is associated with kidney damage and cancer (Broseus et al., 2016). Local anesthetics like lidocaine can trigger cardiac arrhythmias, especially when combined with cocaine's cardiotoxic effects (EMCDDA, 2016).

Overdose and synergistic effects: Fentanyl's 50-100 times potency causes overdoses (28,400 US synthetic opioid deaths in 2018, many heroin-mixed) (Centres for Disease Control and Prevention (CDC), 2018). Fentanyl in cocaine significantly increases overdose risk, contributing to 15% of cocaine-related deaths in the US (2018) (CDC, 2018). Stimulant adulterants (e.g., methamphetamine) exacerbate cardiovascular strain, leading to hypertension and heart failure (UNODC, 2023). Poly-substance mixes (e.g., benzodiazepines like etizolam in <1% of samples) resist naloxone, complicating interventions (UNODC, 2023). Up to 11 components per sample heighten multi-organ failure risks (Ciccarone, 2017).

Infections and contaminants: Unsterile diluents (e.g., talc, starch) cause abscesses, endocarditis, and pulmonary complications when injected (Cole et al., 2010). Bacterial contaminants, though less common than in heroin, have been reported (e.g., Clostridium in rare cases) (UNODC, 2023).

Unpredictable effects: Poly-substance adulteration (e.g., fentanyl with stimulants) complicates emergency responses, as naloxone may not address non-opioid components (Ciccarone, 2017). Only 20% of US overdose death certificates (2016) specified drugs, hindering accurate epidemiology (CDC, 2018).

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CHAPTER THREE: METHODOLOGY

3.1 Study area

The study was conducted in the eight administrative regions of Kenya namely; Nairobi, Central, Eastern, North Eastern, Rift Valley (North Rift and South Rift), Nyanza, Western and Coast. In total, 12 hot-spot counties were covered in the study. The counties included Nairobi, Nakuru, Kisumu, Busia, Uasin Gishu, Kiambu, Nyeri, Isiolo, Garissa, Mombasa, Kilifi and Kwale.

3.2 Study design

The study utilized an exploratory cross-sectional design where both quantitative and qualitative data were generated. While the main methodological approach in contemporary research of drugs remains quantitative, there has been a growing responsiveness to triangulate studies with the use of qualitative methods as a means of in-depth investigation and understanding of the problem (Agar, 1980).

3.3 Implementation strategy

This study was implemented by three teams to cover the twelve (12) sampled hotspot counties. Each team was represented by technical resource persons from the Government Chemist; Pharmacy and Poisons Board; Water and Sewerage Companies; and NACADA.

The study adopted a two (2) pronged strategy:

a. Collection of wastewater samples within the mapped drug hotspots for laboratory analyses and identification of potential illicit drugs and NPS;
b. Collection of drug samples from active drugs users to complement data from WWA. This strategy also provided additional data to assist in the identification of adulterants and cutting agents of commonly used illicit drugs;

3.4 Sampling procedure

Wastewater samples

Collection of wastewater samples was limited to the 5 cities in Kenya namely Nairobi, Mombasa, Nakuru, Kisumu and Eldoret. This selection was informed by the presence of well-established sewerage network, close proximity to the Government Chemist laboratories for storage and preservation of samples, cosmopolitan nature of the population, and large networks of vulnerable populations e.g. students from institutions of higher learning. Also, these 5 cities are known hotspots for illicit drugs and emerging psychoactive substances.

The sampling sites in each of the selected cities were identified prior to the study implementation. In each of the sampled city, the team mapped the drug hotspots through the use of key informants. These hotspots were identified as the sampling points for collection of wastewater samples. The technical team from the collaborating water and sewerage companies guided in the identification of

the most suitable sampling points from the existing sewerage networks (Table 1). The sampling points were also characterized by close proximity to entertainment venues and drug using sites/ dens. Three sampling points were selected from each sampling site.

Drug samples

The study utilized key informant led approach to collect the drug samples. The key informants were current drug users or past drug users. After identification of the first key informant using contact persons from organizations implementing programs focusing on drug users, successive key informants were recruited through chain referral and snowballing sampling methods. This recruitment method was employed until a threshold of 5 – 8 key informants was realized to form a focus group discussion (FGD). A total of 22 FGDs were conducted in the eight regions (Table 1). FGDs were conducted at a venue provided by the area Chief, community social halls or spaces provided by organizations working with drug users. The sampling sites for drug samples were the areas where FGDs were conducted.

Table 1: Sample collection sites

Region	Sampled County	Sampled Sites	Type of Samples
Nairobi	**Nairobi**	Roysambu	Waste Water and Dry Samples
		Lang'ata	Waste Water and Dry Samples
		Mathare/ Eastleigh	Waste Water and Dry Samples
		Westlands	Waste Water and Dry Samples
		CBD	Waste Water and Dry Samples
Nyanza	**Kisumu**	Kisumu City	Waste Water and Dry Samples
		Kondele	Dry Samples
Central	**Nyeri**	Nyeri Central	Dry Samples
		Kiambu	Waste Water and Dry Samples
North Rift Valley	**Uasin Gishu**	Eldoret City	Waste Water and Dry Samples
South Rift Valley	**Nakuru**	Nakuru City	Waste Water and Dry Samples
Eastern	**Isiolo**	Isiolo	

Region	Sampled County	Sampled Sites	Type of Samples
Western	**Busia**	Busia	
Coast	**Mombasa**	Kisauni and Mvita	Waste Water and Dry Samples
		Mvita	Waste Water and Dry Samples
		Bamburi	Waste Water and Dry Samples
		Likoni	Waste Water and Dry Samples
	Kwale	Diani	Waste Water and Dry Samples
	Kilifi	Bahari	Waste Water and Dry Samples
		Malindi	Waste Water and Dry Samples
North Eastern	**Garissa**	Garissa Central	Dry Samples

3.5 Sample collection and storage

Wastewater samples

The collection of wastewater samples was preceded by identification of a suitable sampling site that was nearest to the mapped hotspot. Three (3) grab wastewater samples were collected at 1 hour intervals during peak hours and composited to create one (1) representative sample that captures variations in drug residues in each of the sampled site. Using clean glass containers, a sample of one (1) litre was collected in each sampling site.

Each sample was labeled and given a sample number; date of sampling; the county/ city; sampled site; method of sampling; and the name of the handling officer. After labeling, the samples were kept in a portable cooler box with ice packs at temperatures of 4°C. These conditions were maintained even during transportation of samples to prevent degradation of drug residues and metabolites (Baker & Kasprzyk-Hordern, 2011). The samples were transported within 12 hours to the nearest Government Chemist laboratories in Nairobi, Kisumu and Mombasa for refrigeration.

After completion of the sample collection in each county, the samples were delivered to the main Government Chemist laboratory in Nairobi where they were frozen at -20°C to preserve the stability of compounds, particularly sensitive NPS or metabolites. The receiving officer ensured that each of the samples was securely sealed and labeled. The samples were then carefully stored to minimize

cross-contamination. The sampling forms were also produced in triplicate and given to multiple custodians to guarantee traceability (UNODC, 2009).

Drug samples

Drug samples, such as powders, residues or tablets being used by drug users were collected and sealed in dry ziplock bags and stored in a portable cooler box away from light. In the laboratory, they were preserved at -20°C to maintain compound stability (UNODC, 2009).

3.6 Sample preparation, analyses, identification and interpretation

The procedure for preparation, analyses, and identification was informed by established methodologies (Castiglioni et al., 2014; UNODC, 2009). Analyses and identification of illicit drugs, NPS, and cutting agents in wastewater and drug samples, followed a systematic process, utilizing Gas Chromatography-Mass Spectrometry (GC-MS), UVVis Spectrophotometry, and Colorimetric tests for comprehensive detection. This integrated approach enabled robust detection and identification of illicit drugs, NPS, and cutting agents, supporting effective surveillance of emerging drug use trends in both wastewater and drug samples.

3.6.1 Sample preparation

Wastewater samples

Wastewater samples were filtered through a 0.45 µm membrane to remove particulates and debris. The filtered samples were subjected to solid-phase extraction (SPE) using cartridges to concentrate illicit drugs, NPS, and cutting agents. These were eluted with either methanol or acetonitrile. To minimize matrix interferences, additional clean-up steps, such as liquid-liquid extraction, were performed. Eluates were evaporated under nitrogen and reconstituted in solvents suitable for each of the analytical methods—GCMS, UV-Vis, and Colorimetric tests. For GC-MS analysis, polar compounds, such as certain NPS or metabolites, were derivatized with agents like BSTFA to enhance volatility (Postigo et al., 2008).

Drug samples

For drug samples, the material was dissolved or extracted in a solvent either methanol or ethanol, using sonication to ensure complete extraction. The extract was either filtered or centrifuged to remove insoluble residues and diluted to appropriate concentrations. For GC-MS, derivatization was also applied (UNODC, 2009).

3.6.2 Analyses and identification

Gas Chromatography-Mass Spectrometry (GC-MS)

For GC–MS analysis, an Agilent 7890B gas chromatograph coupled to an Agilent 5977A mass selective detector was used. Separation was achieved using a DB-5MS UI capillary column (phenyl arylene polymer equivalent to 5% phenyl-dimethylpolysiloxane; 30 m × 0.25 mm i.d. × 1.0 µm film thickness). Helium was employed as the carrier gas under constant pressure conditions, with a flow rate of 20.51 mL/min at 40 °C. Samples were introduced in splitless mode, and the injector temperature was maintained at 250 °C. The oven temperature program was set at 40 °C (held for 1 min), ramped at 10 °C/min to 280 °C, and held for 3 min. The mass spectrometer operated in electron ionization (EI) mode at 70 eV, with a solvent delay of 2.75 min, unit mass resolution, and a scan range of 40–500 m/z at a scan rate of 5.9 scans per second.

UV-Vis spectrophotometry

For UV-Vis spectroscopy covering the ultraviolet region, a Shimadzu 1650 PC doublebeam spectrophotometer was used with UV Probe software for data acquisition. The instrument was set to scan from 200 nm to 400 nm within its overall range (190–1100 nm), using a spectral bandwidth of approximately 2 nm and wavelength increments of 0.1 nm for precise resolution. Wavelength accuracy was maintained at about ±0.5 nm with reproducibility near ±0.1 nm carb.

Colorimetric tests

Colorimetric tests involved applying reagents like Marquis, Scott's, or Simon's to sample aliquots in a spot plate or test tube. Color changes (e.g., purple for MDMA with Marquis, blue for cocaine with Scott's) were compared to reference charts for presumptive identification, with confirmation required via GC-MS due to limited specificity (UNODC, 2009).

3.6.3 Interpretation of results

Finally, data interpretation integrated results from all methods to confirm the presence of illicit drugs, NPS and cutting agents or adulterants. GC-MS provided precise identification and quantification, UV-Vis aided in screening, and colorimetric tests offered rapid presumptive results. Cross-validation across methods ensured reliability, particularly for complex wastewater matrices or novel NPS (Hernández et al., 2014). Quality control measures, including blanks, duplicates, and spiked samples, were implemented to monitor matrix effects and ensure analytical accuracy (Castiglioni et al., 2014).

3.7 Data analyses

Descriptive statistics especially frequencies and percentages were used to describe, organize and summarize results from laboratory analyses. Content analysis was used to analyse the qualitative data.

3.8 Ethical considerations

WWA studies raise limited ethical issues because it aggregates data without the identity of specific users. The study also utilized the ethical guidelines for sewage surveillance to monitor drug use set forth by Prichard et al, 2004 where the risk of identifying drug users and communities was safeguarded. Informed consent was sought from the study participants recruited in the FGDs. In addition, their privacy and anonymity was safeguarded.

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Wastewater Analysis

To Assess Emerging New Psychoactive Substances and Illicit Drug Use In Kenya

CHAPTER FOUR: RESULTS

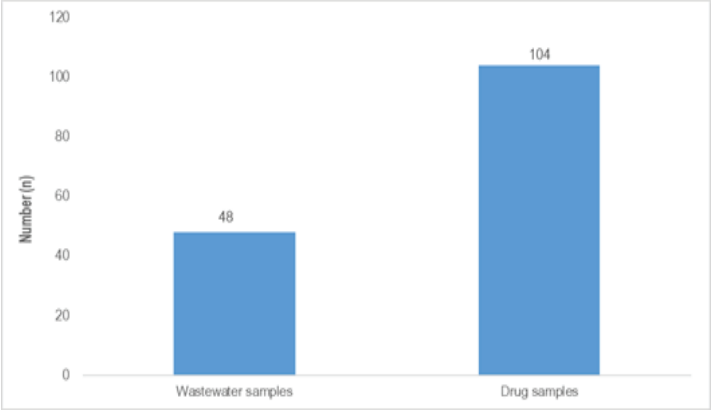
4.1 Introduction

This section presents the findings of laboratory analyses of the wastewater samples and drug samples to identify illicit drugs, NPS and emerging psychoactive substances.

4.2 Summary of analyzed samples

The laboratory report showed that a total of 152 samples were analyzed where 48 were wastewater samples and 104 were drug samples (Figure 1).

Figure 1: Summary of analyzed samples



4.3 Analyses of wastewater samples

Laboratory analyses identified the following maker compounds: butylated hydroxytoluene; benzyl alcohol; pyridine; 3(1-methyl-2-pyrrolidinyl)-(s); 4-methylphenol; tolycaine; acetaminophen; amitriptyline; indole; pyrrolidine 1,5-dimethyl-3,3-diphenyl-2ethylidene-; 3,4-methylenedioxyanisole; benzofuran 2,3-dihydro-; 1H-indole 3-methyl-; alpha-ethyltryptamine; methanone (2-amino-5-chlorophenyl)phenyl; propane 2-nitro; cocaine; and caffeine (Table 2).

Table 2: Wastewater marker compounds and drug associations

Marker compound	Drug class / association	Rationale	References
Pyridine	Methadone, synthetic cathinones	Can appear as impurity in methadone synthesis; also used in synthetic cathinone production	Kelly, 2011; UNODC, 2019
Pyrrolidine, 1,5-dimethyl-3,3-diphenyl-2ethylidene-	Synthetic cathinones (αpyrrolidinophenones)	Structural signature of pyrrolidinophenone stimulants; not from khat or methadone;	Capriola, 2013; Kelly, 2011; Prosser & Nelson, 2012

Marker compound	Drug class / association	Rationale	References
Methanone, (2-amino-5chlorophenyl) phenyl-	Synthetic cathinones, benzodiazepines particularly diazepam	Chlorinated β-keto amphetamine analog; degradation product (aminochlorobenzophenone)	Prosser & Nelson, 2012; UNODC, 2019; Bijlsma et al., 2014
Butylated hydroxytoluene (BHT)	Methadone formulations	Antioxidant excipient in pharmaceutical methadone; indicates pharmaceutical use, not illicit	Capriola, 2013
Benzyl alcohol	Methadone formulations	Antioxidant excipient in pharmaceutical methadone; indicates pharmaceutical use, not illicit	Capriola, 2013
3(1-methyl-2pyrrolidinyl)-(s)	Methamphetamine, cathinone analogues	Pyrrolidine ring; strong synthetic cathinone or stimulant signature	Kelly, 2011; Prosser & Nelson, 2012
4-methylphenol (pcresol)	Amphetamines or methamphetamine / industrial	p-Cresol impurity from illicit amphetamine synthesis processes; Could arise from industrial sources; weak drug indicator alone	Darke et al., 2020; Kinyua et al., 2015
Tolycaine	Tolycaine or adulterant in stimulants	Local anaesthetic with psychoactive Central Nervous System (CNS) effects; marker for direct use or drug adulteration	Bade et al., 2020
Acetaminophen	OTC drugs / poly-drug use/ co-formulations in opioids	Indicates general drug excretion; co-formulant in opioid painkillers, proxy for opioid consumption	Darke et al., 2020; GonzálezMarino et al., 2020
Amitriptyline	Amitriptyline (tricyclic antidepressant)	Excreted un-metabolized, indicating antidepressant/ sedative use/ shows polydrug use trends	Bijlsma et al., 2014; Darke et al., 2020
Indole	Plant-based tryptamines e.g. khat	Could indicate natural psychoactive plant metabolites (e.g., khat)	Kelly, 2011
Pyrrolidine 1,5-dimethyl-3,3-diphenyl-2ethylidene-	Synthetic cathinones	Duplicate; confirm αpyrrolidinophenone presence	Kelly, 2011; Prosser & Nelson, 2012

Marker compound	Drug class / association	Rationale	References
3,4- methylenedioxyanisole	MDMA / synthetic analogues	Methylenedioxy ring; strong stimulant indicator; piperonal-derived precursor/ by-product in MDMA production	Prosser & Nelson, 2012; Kinyua et al., 2015
Benzofuran 2,3-dihydro-	Benzofuran NPS (e.g., 5/6-APB)	Marker for "benzofury" entactogen NPS	Bade et al., 2020.
1H-indole 3-methyl-	Tryptamine-based psychedelics / NPS (e.g. psilocybin and DMT)	Plant-derived or NPS tryptamines; core indole from tryptamine metabolism or synthesis	Kelly, 2011; Bade et al., 2020
Alpha-ethyltryptamine	Synthetic tryptamines (apha-ethyltryptamine (αET))	Direct indicator for synthetic hallucinogenic NPS; not from natural plant sources	Prosser & Nelson, 2012; Zuccato et al., 2011)
Propane 2-nitro (2nitropropane)	Methamphetamine synthesis	Byproduct of reductive amination synthesis; indicates illicit production, not use	Kinyua et al., 2015; Nicol & Quinn, 2012; UNODC, 2006
Cocaine	Cocaine	Gold-standard excretion marker for cocaine use	Darke et al., 2020; Postigo et al., 2010
Caffeine	Caffeine (or adulterant cocaine/ amphetamines or heroin)	Stimulant cut to enhance/ bulk drugs; wastewater levels reflect adulteration; alone may not be indicative of illicit drug use	González-Marino et al., 2020; Darke et al., 2020

Detection of these marker compounds in wastewater indicates presence of psychoactive substance use through WBE, capturing human-excreted metabolites, synthesis byproducts, precursors, or adulterants to monitor community consumption (Daughton, 2018). This combination suggests extensive use of stimulants, opioids, NPS, and pharmaceuticals, with adulterants/ cutting agents indicating impure street drugs and indication of small scale clandestine laboratory activity (Daughton, 2018).

Laboratory results are therefore indicative for the use of the following psychoactive substances: amphetamines; cocaine; methamphetamine; MDMA/ ecstasy; amitriptyline; tryptamine-based psychedelics (e.g., psilocybin and DMT); alpha-ethyltryptamine; benzofurans; tolycaine; benzodiazepines (diazepam); synthetic cathinones and khat. The study also revealed evidence of small scale clandestine laboratory activity related to illicit drug production of synthetic stimulants particularly methamphetamine, MDMA and synthetic cathinones.

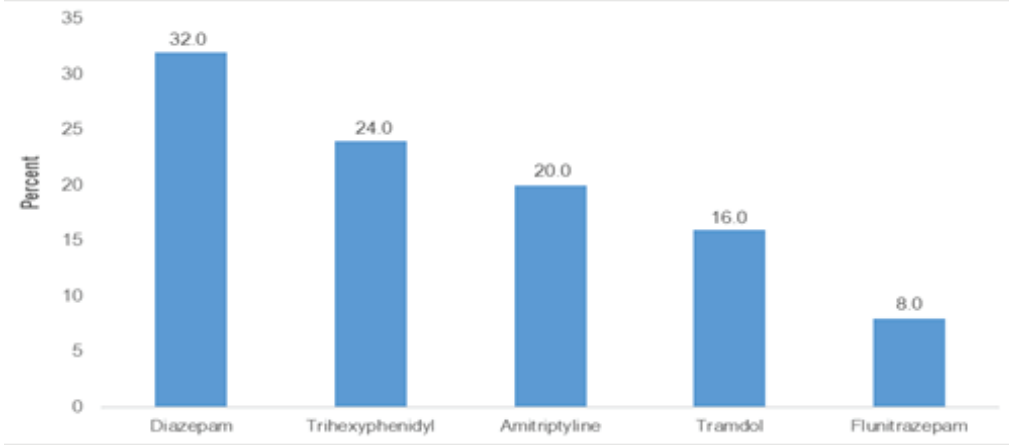
4.4 Analysis of drug samples

The positively identified psychoactive substances were classified into four (4) main categories: prescription drugs; cannabis; heroin; cocaine; and other drugs. The following section presents detailed results of each category:

4.4.1 Prescription drugs

Laboratory analysis confirmed that 25 samples were prescription drugs abused for nonmedical use. Further analyses of the positively identified prescription drugs showed that diazepam was the most widely abused prescription drug (35.2%) followed by trihexyphenidyl (benzhexol/ artane) (24.0%), amitriptyline (20.0%), tramadol (16.0%) and flunitrazepam (rohypnol) (8.0%) (Figure 2).

Figure 2: Commonly abused prescription drugs in Kenya



According to Table 3, abuse of prescription drugs was widespread across the country where 9 out of the 12 sampled hotspot counties had confirmed results of prescription drugs abuse. The affected counties included Nairobi, Kiambu, Busia, Uasin Gishu, Mombasa, Kilifi, Nyeri, Kisumu and Garissa.

Table 3: Results of laboratory analysis for confirmed samples of prescription drugs

No.	Sample No.	Confirmed drug	Sampled County
1.	F/MISC/77/25	Diazepam	Nairobi
2.	F/MISC/78/25	Trihexyphenidyl	Nairobi
3.	F/MISC/79/25	Flunitrazepam	Nairobi
4.	F/MISC/86/25	Trihexyphenidyl	Kiambu
5.	F/MISC/87/25	Diazepam	Kiambu
6.	F/MISC/102/25	Diazepam	Busia

No.	Sample No.	Confirmed drug	Sampled County
7.	F/MISC/103/25	Trihexyphenidyl	Busia
8.	F/MISC/107/25	Trihexyphenidyl	Uasin Gishu
9.	F/MISC/109/25	Amitriptyline	Mombasa
10.	F/MISC/112/25	Tramadol	Mombasa
11.	F/MISC/113/25	Diazepam	Mombasa
12.	F/MISC/114/25	Flunitrazepam	Mombasa
13.	F/MISC/135/25	Diazepam	Garissa
14.	F/MISC/137/25	Tramadol	Garissa
15.	F/MISC/138/25	Amitriptyline	Mombasa
16.	F/MISC/142/25	Diazepam	Mombasa
17.	F/MISC/145/25	Amitriptyline	Kilifi
18.	F/MISC/146/25	Amitriptyline	Kilifi
19.	F/MISC/153/25	Trihexyphenidyl	Kisumu
20.	F/MISC/154/25	Tramadol	Kisumu
21.	F/MISC/155/25	Diazepam	Kisumu
22.	F/MISC/166/25	Trihexyphenidyl	Nyeri
23.	F/MISC/167/25	Amitriptyline	Mombasa
24.	F/MISC/168/25	Tramadol	Mombasa
25.	F/MISC/169/25	Diazepam	Kilifi

Further categorization showed that the prescription drugs were categorized under three (3) broad classes namely: antidepressants; anticholinergic; and opioid analgesics (Table 4).

Table 4: Classification of confirmed prescription drugs

No.	Classification	List of confirmed drugs
1.	Antidepressants	Diazepam, flunitrazepam (rohypnol) and amitriptyline
2.	Anticholinergic	Tryhexiphenidyl/ artane/ benzhexol
3.	Opioid analgesics	Tramadol

4.4.2 Cannabis

Findings showed that the abuse of cannabis was widespread across all the sampled counties. The study showed that besides the smoked cannabis, there was an emerging trend in the use of cannabis edibles. The identified cannabis edibles were mostly —weed cookies‖ (Table 5).

Table 5: Laboratory analysis report for cannabis samples

No.	Sample No.	Identified Drug	Type of Sample	Sampled County
1.	F/MISC/71/25	Cannabis	Herb	Nairobi
2.	F/MISC/72/25	Cannabis	Herb	Nairobi
3.	F/MISC/73/25	Cannabis	Herb	Nairobi
4.	F/MISC/74/25	Cannabis	Cookies	Nairobi
5.	F/MISC/75/25	Cannabis	Cookies	Nairobi
6.	F/MISC/88/25	Cannabis	Herb	Kiambu
7.	F/MISC/89/25	Cannabis	Herb	Kiambu
8.	F/MISC/90/25	Cannabis	Herb	Kiambu
9.	F/MISC/101/25	Cannabis	Herb	Busia
10.	F/MISC/106/25	Cannabis	Herb	Uasin Gishu
11.	F/MISC/108/25	Cannabis	Herb	Mombasa
12.	F/MISC/110/25	Cannabis	Herb	Mombasa
13.	F/MISC/111/25	Cannabis	Herb	Mombasa
14.	F/MISC/122/25	Cannabis	Herb	Nakuru
15.	F/MISC/123/25	Cannabis	Herb	Nakuru
16.	F/MISC/134/25	Cannabis	Herb	Garissa
17.	F/MISC/143/25	Cannabis	Herb	Mombasa
18.	F/MISC/144/25	Cannabis	Herb	Kilifi
19.	F/MISC/147/25	Cannabis	Herb	Kilifi
20.	F/MISC/150/25	Cannabis	Herb	Kisumu
21.	F/MISC/151/25	Cannabis	Herb	Kisumu
22.	F/MISC/152/25	Cannabis	Herb	Kisumu

4.4.3 Heroin

Heroin is the second widely used narcotic drug after cannabis in Kenya. For a long time, abuse of heroin has been more prevalent in the Coastal region and Nairobi. Emerging trend shows that access to heroin has penetrated to other non-traditional counties like Nakuru, Uasin Gishu, Kisumu, Nyeri and Isiolo (Table 6).

Table 6: Laboratory analysis report for heroin samples

No.	Sample No.	Identified Drug	Sampled County
1.	F/MISC/81/25	Heroin	Nairobi
2.	F/MISC/105/25	Heroin	Uasin Gishu
3.	F/MISC/115/25	Heroin	Kisumu
4.	F/MISC/121/25	Heroin	Nakuru
5.	F/MISC/129/25	Heroin	Isiolo
6.	F/MISC/139/25	Heroin	Mombasa
7.	F/MISC/141/25	Heroin	Mombasa
8.	F/MISC/148/25	Heroin	Kilifi
9.	F/MISC/149/25	Heroin	Kilifi
10.	F/MISC/156/25	Heroin	Kisumu
11.	F/MISC/162/25	Heroin	Nyeri
12.	F/MISC/163/25	Heroin	Nyeri
13.	F/MISC/170/25	Heroin	Kilifi

4.4.4 Cocaine

Cocaine is an illegal narcotic drug and a highly addictive stimulant drug under international control. Analyses showed an emerging trend in the use of cocaine in the counties of Nairobi and Nakuru (Table 7).

Table 7: Laboratory analysis report for heroin samples

No.	Sample No.	Identified Drug	Sampled County
1.	F/MISC/69/25	Cocaine	Nairobi
2.	F/MISC/70/25	Cocaine	Nairobi
3.	F/MISC/80/25	Cocaine	Nairobi
4.	F/MISC/119/25	Cocaine	Nakuru
5.	F/MISC/121/25	Cocaine	Nakuru

4.5 Analysis of adulterants or cutting agents in heroin and cocaine samples

Monitoring adulterants and cutting agents in heroin and cocaine via WWA or other methods is essential for protecting public health, understanding drug market dynamics, enhancing epidemiological surveillance, informing policy, and supporting forensic efforts.

By identifying harmful or unexpected compounds, authorities can mitigate risks, target interventions, and disrupt illicit supply chains, ultimately reducing the harm caused by contaminated drugs (Daughton, 2018).

4.5.1 Heroin

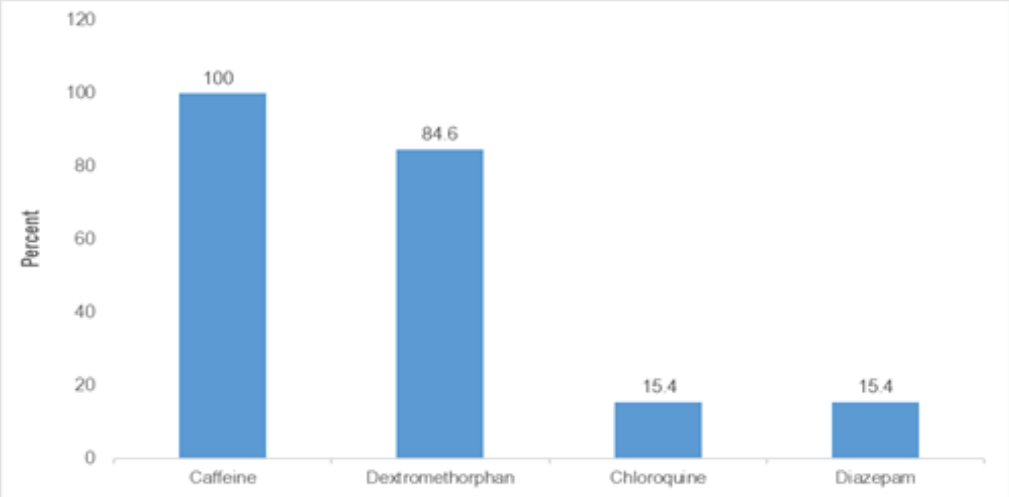
Analyses revealed that caffeine, dextromethorphan, chloroquine and diazepam were the commonly used adulterants or cutting agents for heroin samples (Table 8).

Table 8: Laboratory analyses report for adulterants in heroin samples

No.	Sample no.	Sampled location	Adulterants			
			Caffeine	Dextro-methorphan	Chloro-quine	Diaze-pam
1.	F/MISC/81/25	Nairobi	√	√		√
2.	F/MISC/105/25	Uasin Gishu	√	√		
3.	F/MISC/115/25	Kisumu	√	√		
4.	F/MISC/121/25	Nakuru	√		√	√
5.	F/MISC/129/25	Isiolo	√	√		
6.	F/MISC/139/25	Mombasa	√	√		
7.	F/MISC/141/25	Mombasa	√	√		
8.	F/MISC/148/25	Kilifi	√			
9.	F/MISC/149/25	Kilifi	√	√	√	
10.	F/MISC/156/25	Kisumu	√	√		
11.	F/MISC/162/25	Nyeri	√	√		
12.	F/MISC/163/25	Nyeri	√	√		
13.	F/MISC/170/25	Kilifi	√	√		
	Total Samples		**13**	**11**	**2**	**2**

Figure 3 showed that caffeine (100%) and dextromethorphan (84.6%) were the most commonly used adulterants or cutting agents for heroin in Kenya.

Figure 3: Commonly used adulterants/ cutting agents for heroin samples



4.5.2 Cocaine

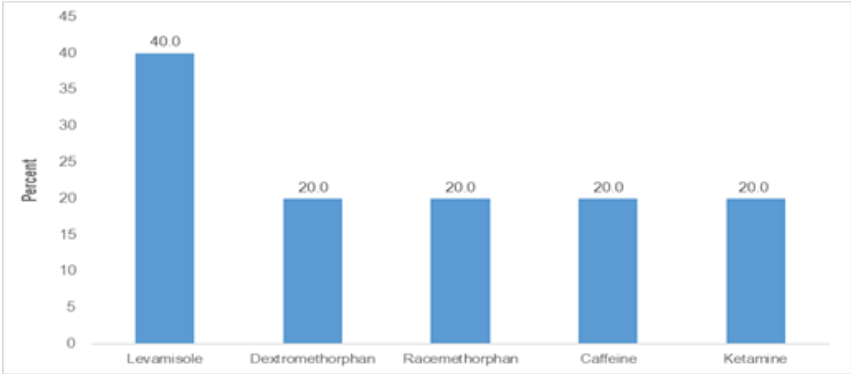
Analyses revealed that levamisole, dextromethorphan, racemethorphan, caffeine and ketamine were the commonly used adulterants or cutting agents for cocaine samples (Table 9).

Table 9: Laboratory analyses report for adulterants in cocaine samples

No.	Sample	Sampled location	Adulterants				
			Levamisole	Dextromethorphan	Racemethorphan	Caffeine	Ketamine
1.	F/MISC/69/25	Nairobi	√				
2.	F/MISC/70/25	Nairobi					
3.	F/MISC/80/25	Nairobi	√		√		
4.	F/MISC/119/25	Nakuru					
5.	F/MISC/121/25	Nakuru		√		√	√
	Total Samples		2	1	1	1	1

Figure 4 showed that levamisole (40.0%) was the most commonly used adulterant or cutting agent for cocaine in Kenya.

Figure 4: Commonly used adulterants/ cutting agents for cocaine samples



4.6 Focus group discussions

The survey team conducted FGDs with drug users to understand emerging drug use trends including the major substances of abuse; demographic characteristics of users; and the poly-drug use patterns.

4.6.1 Commonly used illicit drugs and other psychoactive substances

Feedback from the FGDs showed that cannabis, heroin, cocaine, khat, mandrax, methamphetamine, hashish, MDMA/ ecstasy and prescription drugs were the most commonly used psychoactive substances.

The most commonly reported prescription drugs were diazepam/ cozepam, flunitrazepam/ rohypnol, amitriptyline, tramadol, chlorpromazine (largactil), morphine and cetrizine.

4.6.2 Demographic characteristics of drug users

The FGDs explored the demographic characteristics of drug users across the selected hotspot counties. Data revealed that most of the users were aged 13 – 25 years, slightly more male compared to female users and majority were unemployed. It was also reported that the problem was on the increase among students and medical professionals.

4.6.3 Poly-drug use patterns

One of the objectives of the study was to understand the poly-drug use patterns among drug users. It was reported that poly-drug use enables the users to experience stronger or longer-lasting highs. The other commonly reported risk factor for poly-drug use was the aspect of cost especially among heroin users. It was reported that poly-drug use leads to the use of fewer doses of heroin, whose affordability is a major challenge. Analysis of the FGD responses revealed the following commonly used drug combination patterns:

a. Heroin + diazepam

b. Heroin + cannabis
c. Heroin + cannabis + tobacco (referred to as —cocktail‖)
d. Cannabis + tramadol
e. Cannabis + methamphetamine + hashish
f. Khat + benzhexol + alcohol
g. Khat + diazepam
h. Methadone + cannabis
i. Methadone + diazepam
j. Alcohol +flunitrazepam (Rohypnol)
k. Alcohol + codeine
l. Alcohol + chlorpheniramine (piriton)

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CHAPTER FIVE: DISCUSSION

5.1 Emerging NPS and illicit drug use in Kenya

This study has shown the potential of WWA in understanding the emerging drug use trends and serving as a reliable surveillance toolkit for NPS and illicit drug use. The study relied on evidence from both wastewater samples and drug samples from active users.

Drug samples

The drug samples revealed to a large extent the profile of illicit drug use in Kenya. Evidence from drug users showed that cannabis, heroin, cocaine and prescription drugs (diazepam, trihexyphenidyl (artane), amitriptyline and tramadol) were the most commonly used substances. However, worth noting was the increasing availability of tramadol in the illicit drug use market. Findings also showed an emerging use of cocaine in Nairobi and Nakuru counties, an indication that its use may be on the increase.

Wastewater samples

Analyses of wastewater samples revealed interesting findings to inform the emerging drug use trends in Kenya. The study showed evidence of NPS, emerging psychoactive substances, small scale clandestine laboratory activity related to illicit drug production and prescription drugs.

NPS

Laboratory analyses report showed evidence for the existence of the following NPS:

a. Alpha-ethyltryptamine (α-ET)
b. Benzofurans
c. Synthetic cathinones

Alpha-ethyltryptamine (α-ET) is often classified as NPS having emerged in recreational drug markets relatively recently and were initially unregulated in many jurisdictions (Corkery et al., 2012). These substances were designed to mimic the effects of controlled psychedelics like LSD or DMT while exploiting legal loopholes before being banned. Tryptamine-based NPS have been associated with severe adverse effects, including psychosis, serotonin syndrome, and fatalities (Corkery et al., 2012).

These risks have prompted many countries to schedule these substances. For example, α-ET are now Schedule I substances in the US while in the UK it is already a banned substance (Drug Enforcement Administration, 2020; Corkery et al., 2012).

Benzofurans are classified as a category of NPS. NPS are defined as substances of abuse that are not controlled under the 1961 UN Single Convention on

Narcotic Drugs or the 1971 UN Convention on Psychotropic Substances but may pose a public health threat, often emerging recently in recreational markets as alternatives to controlled drugs (United Nations Office on Drugs and Crime, 2024).

Benzofurans belong to the phenethylamine family and are synthetic stimulants with entactogenic (empathy-enhancing) and hallucinogenic effects, structurally similar to amphetamines and MDMA (3, 4-methylenedioxymethamphetamine) (Galindo et al., 2019; Negus et al., 2021). These substances are the third most prominent group of NPS after synthetic cannabinoids and cathinones, with over 20 benzofuran variants reported globally by the UNODC (Negus et al., 2021; United Nations Office on Drugs and Crime, 2024). They are often misrepresented or adulterated in products mimicking ecstasy pills, contributing to their rapid spread (Galindo et al., 2019). Benzofurans act primarily as serotonin, dopamine, and norepinephrine releasers, producing euphoria, increased empathy, and mild hallucinations similar to MDMA (Monte et al., 2018).

Synthetic cathinones, marketed as —bath salts‖, are a group of NPS that mimic the effects of conventional stimulants such as amphetamine, methamphetamine, MDMA (ecstasy), and cocaine (Bailey et al., 2020). Chemically, they are β-keto analogs of amphetamine, structurally derived from cathinone, the natural stimulant found in the khat plant (Catha edulis), which has been chewed for centuries in East Africa and the Arabian Peninsula (Kelly, 2011).

As of 2024, the UNODC Early Warning Advisory monitors 209 synthetic cathinones globally (UNODC, 2024), while the EU Early Warning System tracks 162 (EMCDDA, 2024). These substances exert their effects by inhibiting or reversing the reuptake of dopamine (DAT), norepinephrine (NET), and serotonin (SERT) transporters, producing intense psycho-stimulation comparable to or exceeding that of methamphetamine or cocaine (Baumann et al., 2013; Simmler et al., 2013). This mechanism drives rapid tolerance, compulsive re-dosing, and addiction liability, with users exhibiting binge patterns lasting days (American Addiction Centers, 2024).

Emerging psychoactive substances

Report of laboratory analyses also revealed evidence of emerging psychoactive substances in Kenya namely:

a. Methamphetamine
b. MDMA (ecstasy)
c. Tryptamine-based psychedelics (psilocybine and DMT)

Methamphetamine is listed as a Schedule II substance under the 1971 UN Convention and in the US Controlled Substances Act, indicating strict international and national control due to its high abuse potential (Drug Enforcement

Administration, 2023). Methamphetamine is a potent CNS stimulant, increasing dopamine, norepinephrine, and serotonin levels, leading to euphoria, increased energy, and potential for addiction (Negus et al., 2021).

MDMA is listed as a Schedule I substance under the 1971 UN Convention on Psychotropic Substances and in the US Controlled Substances Act, indicating strict international and national control due to its high abuse potential and lack of accepted medical use at the time of scheduling (Drug Enforcement Administration, 2023). In the UK, it is a Class A drug under the Misuse of Drugs Act (Home Office, 2023). MDMA is a synthetic drug with both stimulant and empathogenic effects, primarily acting as a serotonin, dopamine, and norepinephrine releaser, producing euphoria, increased empathy, and mild hallucinogenic effects (National Institute on Drug Abuse, 2020).

Tryptamine-based psychedelics e.g. **psilocybin** (found in magic mushrooms) and **DMT** (found in ayahuasca) are regulated under international drug control frameworks (United Nations Office on Drugs and Crime, 2013). These substances are listed in schedules of the 1971 UN Convention.

Small scale clandestine laboratory activity

The study revealed evidence of small scale clandestine laboratory activity related to illicit drug production of synthetic stimulants especially methamphetamine, MDMA and synthetic cathinones. It has been shown that WBE is increasingly utilized to detect illicit drug production and clandestine synthesis by identifying specific chemical markers in sewage systems. This method leverages the fact that clandestine labs generate significant volumes of toxic waste leaving detectable chemical signatures (Emke et al., 2018; UNODC, 2020).

These markers help differentiate production-related waste from residues of drug consumption, aiding law enforcement in locating clandestine labs. The approach is particularly effective for monitoring synthetic drugs such as amphetamines, methamphetamine, synthetic cathinones, and MDMA (Emke et al., 2018; UNODC, 2020). For example, analysis reported a byproduct of reductive amination synthesis which refers to chemical compounds produced as secondary or unintended products during the synthesis of illicit drugs, such as amphetamines, methamphetamine, synthetic cathinones, or MDMA, via the reductive amination process. These byproducts are distinct from the target drug and its precursors, and their presence in wastewater can serve as specific markers for detecting clandestine drug production (Postigo et al., 2021; Bade et al., 2020).

Prescription drugs

Analysis also showed evidence of abuse of prescription drugs for non-medical use especially benzodiazepines (diazepam) and amitriptyline. Benzodiazepines are a class of psychoactive drugs used primarily for their sedative, anxiolytic,

muscle-relaxant, and anticonvulsant effects (Griffin et al., 2013; UNODC, 2020).

Amitriptyline (AMI), a tricyclic antidepressant (TCA) prescribed for depression, anxiety, and chronic pain, has a recognized potential for abuse due to its sedative, euphoric, and anticholinergic effects (Du et al., 2024; Tatarova et al., 2024). AMI is misused by drug users seeking its psychoactive effects, often in combination with other substances to enhance sedation or euphoria (Prah et al., 2020).

5.2 Adulterants or cutting agents for heroin and cocaine

Analysis showed that caffeine, dextromethorphan, chloroquine and diazepam were the commonly used adulterants or cutting agents for heroin samples. Also, the report revealed that levamisole, dextromethorphan, racemethorphan, caffeine and ketamine were the commonly used adulterants or cutting agents for cocaine samples. Adulterants in heroin and cocaine, such as caffeine, fentanyl, acetaminophen, or local anesthetics like tolycaine, can significantly alter the toxicity, potency, and health risks of these substances. Monitoring these compounds in wastewater helps identify harmful adulterants circulating in the drug supply, enabling public health interventions to reduce overdoses and adverse effects (Broseus et al., 2016).

Analyses showed that diazepam and ketamine were emerging adulterants or cutting agents for heroin and cocaine respectively in Kenya. The UNODC guidelines on heroin impurity profiling identify diazepam as a non-opiate adulterant in street samples (UNODC, 2019).
Diazepam enhances heroin's sedative and euphoric effects by acting on GABA-A receptors, creating a more intense —high‖ or masking the reduced potency of low-quality heroin (Kaur et al., 2022; British Columbia Coroners Service, 2024). This is particularly relevant during supply disruptions, as observed in India during the COVID-19 pandemic (Kaur et al., 2022).

Ketamine, a dissociative anesthetic with hallucinogenic properties, is occasionally reported as an adulterant or contaminant in cocaine samples, though it is not a common or standard cutting agent compared to substances like levamisole, caffeine, or lidocaine (American Addiction Centers, 2025; AdCare, 2024; Giné et al., 2014). Global reports, such as those from the UNODC, do not list ketamine among common cocaine adulterants (e.g., levamisole, phenacetin, caffeine), indicating its presence is rare or incidental (UNODC, 2019; Solimini et al., 2017). If deliberately added, ketamine could mitigate cocaine's jittery stimulant effects, providing a dissociative —balance‖ to the high, potentially making low-purity cocaine more appealing to users (Palamar et al., 2021; Erowid, 2019). This effect is more characteristic of user mixtures than dealer practices.

5.3 Poly-drug use patterns

Poly-drug use, the consumption of two or more psychoactive substances simultaneously or concurrently, is prevalent among drug users and increases risks of overdose, infections, and poorer treatment outcomes (EMCDDA, 2023; Cicero et al., 2020). The study explored the emerging trend of poly-drug use and documented common patterns among drug users. Analysis of the FGD responses from drug users identified the following drug combinations:

a. Heroin + diazepam
b. Heroin + cannabis
c. Heroin + cannabis + tobacco (referred to as —cocktail‖)
d. Cannabis + tramadol
e. Cannabis + methamphetamine + hashish
f. Khat + trihexyphenidyl (benzhexol/ artane) + alcohol
g. Khat + diazepam
h. Methadone + cannabis
i. Methadone + diazepam
j. Alcohol + flunitrazepam (rohypnol)
k. Alcohol + codeine
l. Alcohol + chlorpheniramine (piriton)

Poly-drug use is a commonly reported phenomenon globally. Comparatively, data shows that over 70-80% of people who misuse prescription opioids or use heroin report past-month poly-drug use, based on U.S. National Household Survey on Drug Use and Health data from 2017-2019 (Cicero et al., 2020). Among club drug users, 60-70% engage in poly-drug combinations, particularly in social settings like raves (Palamar et al., 2015). Research also shows that approximately 50% of women using cocaine, heroin, or methamphetamine are poly-drug users (Lorvick et al., 2018).

In Europe, 50-60% of treatment entrants exhibit poly-drug profiles, often including alcohol and cannabis (EMCDDA, 2023). Among adolescents initiating cannabis use, 27.5% report additional drug use within a year, escalating to 67% using two or more substances (Silins et al., 2013). The most immediate consequences of poly-drug use relates to drug overdose or toxicity. For example, overdose data shows 63% of U.S. opioid-related deaths involve co-substances like cocaine or benzodiazepines e.g. diazepam (Hedegaard et al., 2020), while poly-drug toxicity drives most illicit drug deaths in Europe (EMCDDA, 2023).

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CHAPTER SIX: CONCLUSION AND RECOM-MENDATIONS

6.1 Introduction

This section discusses the key findings of the study on WWA to assess emerging NPS and illicit drug use in Kenya.

6.2 Illicit drug use patterns

Analysis of drug samples collected from users confirmed use of the following psychoactive substances:

a. Cannabis
b. Heroin
c. Cocaine
d. Prescription drugs - diazepam, trihexyphenidyl (artane), amitriptyline and tramadol

New psychoactive substances (NPS)

WWA report confirmed the existence of the following NPS:

a. Alpha-ethyltryptamine (α-ET)
b. Benzofurans
c. Synthetic cathinones

Emerging psychoactive substances

WWA also confirmed the existence of emerging psychoactive substances in Kenya namely:

a. Methamphetamine
b. MDMA (ecstasy)
c. Tryptamine-based psychedelics (psilocybine and DMT)

Small scale clandestine laboratory activity

- The findings of laboratory analysis of wastewater samples revealed evidence of illicit drug production and possible existence of small scale clandestine laboratory activity;
- The results indicate possible production of synthetic stimulants specifically methamphetamine, MDMA and synthetic cathinones;

6.3 Adulterants or cutting agents for heroin and cocaine

- Analysis showed that caffeine, dextromethorphan, chloroquine and diazepam were the commonly used adulterants or cutting agents for heroin samples;
- Levamisole, dextromethorphan, racemethorphan, caffeine and ketamine were the commonly used adulterants or cutting agents for cocaine samples;
- Analysis also confirmed that diazepam and ketamine were emerging adulterants or cutting agents for heroin and cocaine specifically respectively.

6.4 Poly-drug use patterns

The study explored the problem of poly-drug use and documented common patterns among drug users. Analysis of the FGD responses from drug users identified the following drug combinations:

a. Heroin + diazepam
b. Heroin + cannabis
c. Heroin + cannabis + tobacco (referred to as —cocktail‖)
d. Cannabis + tramadol
e. Cannabis + methamphetamine + hashish
f. Khat + trihexyphenidyl (benzhexol/ artane) + alcohol
g. Khat + diazepam
h. Methadone + cannabis
i. Methadone + diazepam
j. Alcohol + flunitrazepam (rohypnol)
k. Alcohol + codeine
l. Alcohol + chlorpromazine (piriton)

6.5 Recommendations

According to the findings of this study, there was evidence of emerging drug use trends including NPS. Therefore, in view of these evolving outcomes, the study proposes the following recommendations: There is need for:

a. NACADA in collaboration with the relevant stakeholders to establish a National Wastewater Drug Surveillance and Early Warning System (EWS) to inform timely and coordinated response to mitigate emerging threats of NPS;

b. The Ministry of Interior and National Coordination to strengthen the Government Chemist, the national forensic laboratory with equipment and detection capabilities of emerging NPS;

c. The relevant enforcement agencies to adopt intelligence-led surveillance to identify and dismantle clandestine laboratories to curb illicit drug production and disruption of illicit drug supply chains. This includes monitoring and controlling the diversion of precursor chemicals used in the illicit manufacture of synthetic drugs and other emerging NPS;

d. The Ministry of Health in collaboration with the Government Chemist and NACADA to undertake continuous monitoring of adulterants and cutting agents in addition to establishment of an Adulterant Alert System to mitigate potential risks related to drug overdose;

e. The Ministry of Health to review the national treatment guidelines to provide for transition from single-substance treatment to integrated poly-drug management models;

f. The Pharmacy and Poisons Board to strengthen the pharmaceutical regulation and prescription monitoring to mitigate diversion and misuse of these drugs as emerging legal —highs‖;

g. NACADA in collaboration with the county governments to undertake regular and sustained public education and awareness on the effects and risks of emerging drugs and NPS including targeted deployment of prevention campaigns in universities and nightlife settings;

h. Regular scheduling of emerging drugs and NPS to restrict their illegal production, distribution, possession and their availability on the market including review of the current scheduling framework to provide for rapid control of NPS; .

i. NACADA to strengthen the National Drug Observatory to integrate wastewater analysis, forensic, hospital and treatment data to inform timely response;

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ACTION PLAN TO IMPLEMENT THE RECOM-MENDATIONS

1. Institutionalize wastewater-based epidemiology (WBE) as a National Early Warning System

Rationale

WWA confirmed emerging NPS (α-ET, benzofurans, synthetic cathinones), methamphetamine, MDMA, and possible small scale clandestine production. Therefore, Kenya needs a real-time drug surveillance mechanism.

Recommendation

NACADA in collaboration with the relevant stakeholders to establish a National Wastewater Drug Surveillance and Early Warning System (EWS) to inform timely and coordinated response to mitigate emerging threats of NPS

Action Plan

Action	Responsible Agency	Key Outputs
Establish inter-agency technical working group for WWA surveillance (NACADA, Government Chemist, Water and Sewerage Companies, Universities and Law Enforcement Agencies)	NACADA	National WBE framework
Develop standardized WBE sampling and analytical protocol	Government Chemist and Academic laboratories	National WBE SOP
Design a national NPS Early Warning Dashboard	NACADA	Real-time reporting system

2. Strengthen forensic and toxicological laboratory capacity

Rationale

Detection of NPS, adulterants (levamisole, ketamine, diazepam), and clandestine lab signatures requires advanced forensic capability.

Recommendation

The Ministry of Interior and National Coordination to strengthen the Government Chemist, the national forensic laboratory with equipment and detection capabilities of emerging NPS

Action Plan

Action	Responsible Agency	Key Outputs
Invest in LC-MS/MS and high-resolution mass spectrometry	Ministry of Interior, Treasury and Government Chemist	Enhanced NPS detection

Action	Responsible Agency	Key Outputs
Train analysts and law enforcement on emerging NPS	Government Chemist, Anti-Narcotics Unit, National Police Service and Universities	Skilled detection team
Develop national NPS reference library	Government Chemist	Updated compound database
Partner with international partners (e.g., UNODC)	NACADA, Government Chemist and Anti-Narcotics Unit	Technical and equipment support, capacity building & intelligence sharing

3. Targeted law enforcement against clandestine laboratories

Rationale

WWA report indicates local production of methamphetamine, MDMA, and synthetic cathinones.

Recommendation

The relevant enforcement agencies to adopt intelligence-led surveillance to identify and dismantle clandestine laboratories to curb illicit drug production and disruption of illicit drug supply chains. This includes monitoring and controlling the diversion of precursor chemicals used in the illicit manufacture of synthetic drugs and other emerging NPS

Action Plan

Action	Responsible Agency	Key Outputs
Map precursor chemical importation and distribution	Pharmacy and Poisons Board and Anti-Narcotics Unit	Chemical diversion control system
Conduct joint operations	Anti-Narcotics Unit and Directorate of Criminal Investigations	Lab dismantling operations
Introduce precursor chemical tracking registry	Pharmacy and Poisons Board	Controlled chemical supply chain

4. Public health response to adulterants and management of overdose risks

Rationale

Levamisole (linked to agranulocytosis), ketamine, and diazepam adulteration significantly increase overdose and toxicity risks.

Recommendation

The Ministry of Health in collaboration with the Government Chemist and NACADA to undertake continuous monitoring of adulterants and cutting agents

in addition to establishment of an Adulterant Alert System to mitigate potential risks related to drug overdose

Action Plan

Action	Responsible Agency	Key Outputs
Issue public health alerts on adulterants	Ministry of Health	Risk communication bulletins
Scale up naloxone distribution programs	Ministry of Health, Pharmacy and Poisons Board and County Governments	Reduced opioid mortality
Train healthcare workers on NPS toxicity	Ministry of Health and County Governments	Updated treatment protocols

5. Address poly-drug use through integrated treatment models

Rationale

Poly-drug use (e.g., heroin + diazepam, methadone + cannabis, alcohol + flunitrazepam) significantly increases overdose risk.

Recommendation

The Ministry of Health to review the national treatment guidelines to provide for transition from single-substance treatment to integrated poly-drug management models

Action Plan

Action	Responsible Agency	Key Outputs
Update national treatment guidelines to include poly-drug protocols	Ministry of Health	Revised national guidelines
Integrate mental health and addiction services	Ministry of Health and County Governments	Dual-diagnosis services
Expand medication-assisted treatment (MAT) coverage	Ministry of Health and CSOs/ NGOs	Increased methadone coverage
Community-based peer harm reduction education	NGOs/ CSOs and County Governments	Reduced risky combinations

6. Regulate the handling of prescription drugs

Rationale

High misuse of diazepam, tramadol, trihexyphenidyl, amitriptyline.

Recommendation

The Pharmacy and Poisons Board to strengthen the pharmaceutical regulation

and prescription monitoring to mitigate diversion and misuse of these drugs as emerging legal —highs‖

Action Plan

Action	Responsible Agency	Key Outputs
Implement electronic prescription monitoring system	Pharmacy and Poisons Board	Reduced diversion
Audit high-risk pharmacies	Pharmacy and Poisons Board	Compliance enforcement
Reclassify high-risk medications where necessary	Ministry of Health and Pharmacy and Poisons Board	Regulatory amendments
Sensitize prescribers on misuse trends	Pharmacy and Poisons Board, Medical Practitioners and Dentist Board	Responsible prescribing

7. General public, youth and university-focused prevention strategy

Rationale

Emerging MDMA, methamphetamine, and psychedelic use suggests growth in recreational/urban markets.

Recommendation

NACADA in collaboration with the county governments to undertake regular and sustained public education and awareness on the effects and risks of emerging drugs and NPS including targeted deployment of prevention campaigns in universities and nightlife settings

Action Plan

Action	Responsible Agency	Key Outputs
Conduct campus drug surveillance surveys	Universities and NACADA	Trend reports
Launch youth-focused awareness campaigns	NACADA	Behavior change messaging
Partner with nightlife venues for harm reduction messaging	County Governments	Safer nightlife initiative

8. National drug policy review and NPS scheduling reform

Rationale

Rapid emergence of NPS requires flexible scheduling laws.

Recommendation

Regular scheduling of emerging drugs and NPS to restrict their illegal production,

distribution, possession and their availability on the market including review of the current scheduling framework to provide for rapid control of NPS

Action Plan

Action	Responsible Agency	Key Outputs
Review existing narcotics legislation	Anti-Narcotics Unit and NACADA	Policy review report
Introduce analogue-based scheduling amendments	Anti-Narcotics Unit and Pharmacy and Poisons Board	Legislative reform
Establish rapid temporary banning mechanism	Ministry of Interior	Faster control of new NPS

9. Research and data integration platform

Rationale

Triangulation (WWA + user samples + Qualitative Methods) proved effective.

Recommendation

NACADA to strengthen the National Drug Observatory to integrate wastewater analysis, forensic, hospital and treatment data to inform timely response

Action Plan

Action	Responsible Agency	Key Outputs
Integrate WWA, forensic, hospital, and treatment data	NACADA, Ministry of Health and Government Chemist	National drug database
Annual national drug situation report	NACADA	Evidence-based planning
Fund academic research on NPS trends	National Research Fund	Peer-reviewed studies

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ANNEX

Annex 1: Identified substances by their street names

Cannabis

The table below presents the street names for cannabis documented during FGDs with drug users.

Street names for cannabis

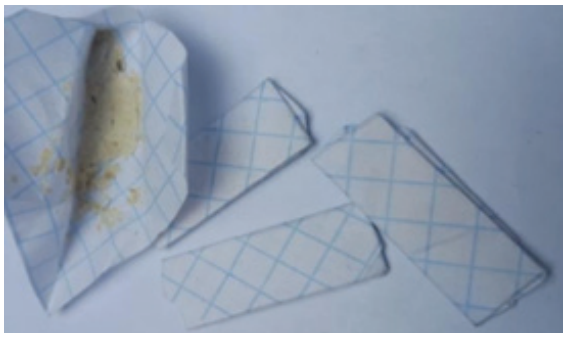
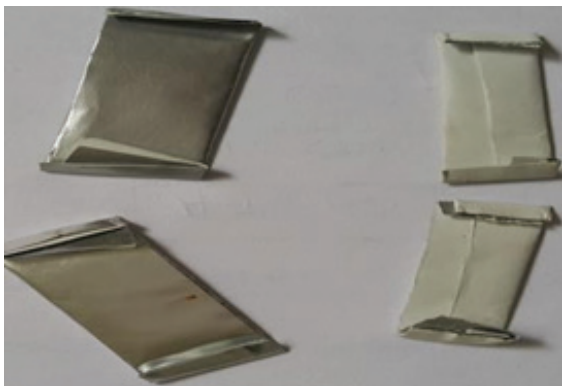
Sampled Drug	Name	Street names
	Cannabis	- Shash (marijuana from shashamane) - Bangi - Moshi - Slim (marijuana from shashamane) - Koro(local marijuana) - Local (local marijuana) - Kitunguu nice (marijuana from shashamane due to the “sweet smell”) - Vela - Ndom - Kindom - Kindukulu - Ndukulu - Gush (local marijuana) - Taifa - Tagi (local marijuana) - Kisumu (local marijuana) - Kishash - Ndom - Kigode - Kingdom - Shada - Kikolo - Foreign - Skunk - Malawian Gold - Colorado - Durban - Indica - Bongo - Maloud - Bush
	Cannabis	
	Cannabis	
	Cannabis	
	Cannabis	

Sampled Drug	Name	Street names
	Cannabis	
	Cannabis	
	Edible cannabis	Weed cookies

Heroin

The table below presents the street names for cocaine documented during FGDs with drug users.

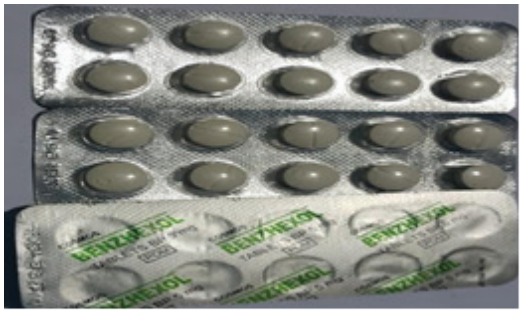
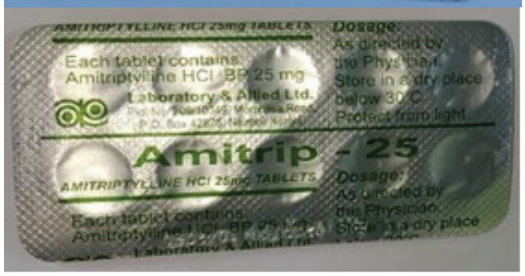
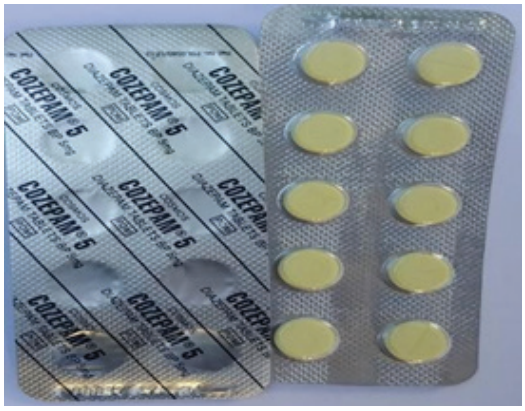
Street names for heroin

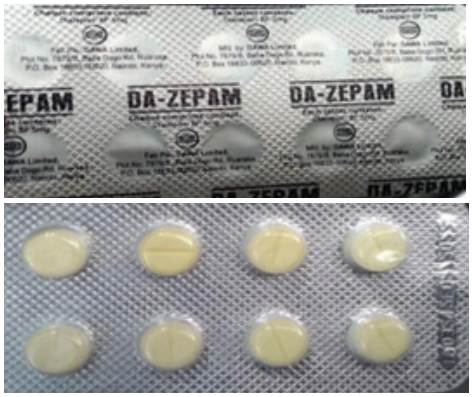
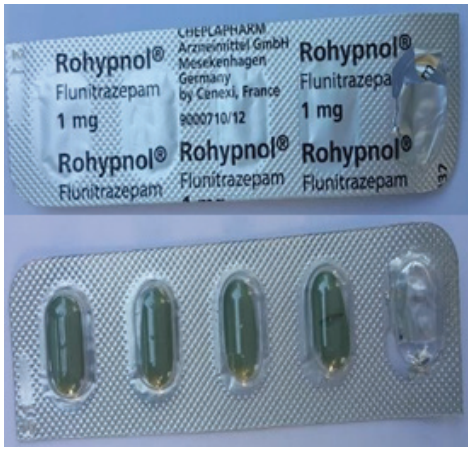
Sampled Drug	Name	Street names
	Heroin	- Kichuri - Kucha - Mondo - Dawa - Kikete - Kete - Stuff - Unga - Brown - Dragon - White crest - Brown crest
	Heroin	- Mzigo - Brown sugar - Nairobi flower(heroin from Nairobi) - Karachi (heroin from Tanzania) - Ngoma - Chwiri - Mnanda - Boroka - Pashwar
	Heroin	- Mnanda - Boshi

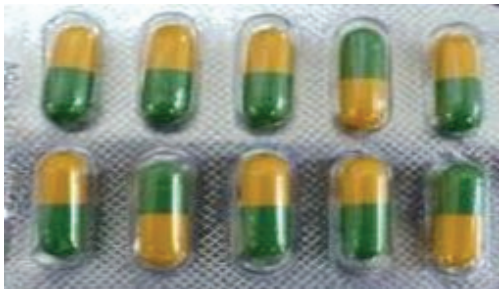
Prescription drugs

The table below presents the street names for prescription drugs documented during FGDs with drug users.

Street names for prescription drugs

Sampled Drug	Trade names	Street names
	Benzhexol (artane)	- White - Cosmos - Tembe - Maduya - Tap tap - Tuxe - Nduxe - Benzos - Zii
 	Amitriptyline	- Red beret - Red - Cosmos - Ma-red - Orange - Maorange - Red ballet - Red devil - Bwana red - Red devil
	Cozepam/ diaz-epam	- C5 - C - Mayellow - Cosmos - Tembe - D5

Sampled Drug	Trade names	Street names
		
	Flunitrazepam (rohypnol)	- Bugizi - Blue - Mchele - Tembe - Digda - Alanka - Roche
	Codeine syrup	- Codica - Shorobo - Siku nusu

Sampled Drug	Trade names	Street names
 	Tramadol	- Tramadol

Cocaine

The table below presents the street names for cocaine documented during FGDs with drug users.

Street names for cocaine

Sampled Drug	Trade names	Street names
 	Cocaine	- Crack - Dibii - Coke

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