Nigerian Medical Journal
NIGERIA MEDICAL ASSOCIATION
Print ISSN 0300-1652, E-ISSN 2229-774X

Original Article

Drug Use Burden and Enforcement Indicators in Nigeria: A Retrospective Ecological Analysis

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Abstract

Background: Nigeria faces a substantial burden of illicit drug use alongside intensified enforcement activity. However, the geographic correspondence between enforcement indicators and population-level drug use burden remains poorly characterised. This study provides an ecological assessment of enforcement–burden alignment in Nigeria and introduces a Total Seizure-to–Any-Drug-User Ratio (TSUR) as a policy-relevant surveillance metric.

Methodology: We conducted a retrospective ecological analysis of Nigeria's six geopolitical zones. Drug use burden was obtained from the 2018 Drug Use in Nigeria survey; seizure, arrest, and conviction data were extracted from National Drug Law Enforcement Agency (NDLEA) reports (2021–2022). We calculated a Total Seizure-to–Any-Drug-User Ratio (TSUR; kg seized per 1,000 estimated past-year users) using 2018 survey denominators and 2021–2022 NDLEA seizure totals. Associations were assessed using Spearman's rank correlation (n = 6 zones). To evaluate robustness to temporal mismatch, we conducted sensitivity analyses assuming ±10–20% changes in zonal prevalence.

Results: Past-year drug use prevalence ranged from 10.0% to 22.4% across zones. National seizures increased substantially between 2021 and 2022 and were dominated by cannabis by weight. TSUR varied markedly across geopolitical zones (<5 kg to >300 kg per 1,000 users), indicating substantial geographic differences in seizure intensity relative to the 2018 baseline distribution of drug users. Zone-level correlations between seizure weight and estimated users were positive but statistically unstable, given the small number of aggregate units.

Conclusions: Marked regional variation exists in both drug use burden and enforcement activity across Nigeria. Using a historical demand-side baseline and subsequent enforcement indicators, this analysis demonstrates only partial geographic concordance between seizures and estimated user burden. The TSUR provides a transparent, scalable metric for contextualising enforcement activity alongside epidemiological estimates in data-constrained settings, when interpreted cautiously.

Keywords: Nigeria; drug seizures; drug use burden; ecological analysis; NDLEA; surveillance

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How to Cite: Albert OM, Arthur A. Drug Use Burden and Enforcement Indicators in Nigeria: A Retrospective Ecological Analysis. *Niger Med J*. 2026;67(1): 2695-2711. https://doi.org/10.71480/nmj.v67i1.1258

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Introduction

Nigeria bears a substantial and heterogeneous burden of psychoactive substance use. The first national *Drug Use in Nigeria* survey, conducted in 2018, estimated that 14.4% of people aged 15–64 years had used at least one drug in the preceding year, corresponding to approximately 14.3 million people [1]. Spatial analysis of the same survey data demonstrates marked geographic clustering of drug use, supporting the analytical relevance of regional units such as the six geopolitical zones for ecological comparison and policy planning [2]. The UNODC *Bulletin on Narcotics* volume focused on drugs in a Nigerian population, further underscoring the diversity of substances, consumption patterns, and risk profiles captured by national reporting [3]. Earlier epidemiological studies highlight the longstanding public health importance of substance use and substance use disorders in Nigeria [4]. Nigeria's large population base and pronounced socioeconomic gradients, documented in official demographic and poverty statistics, provide additional rationale for examining regional variation in both demand-side burden and supply-side enforcement indicators [5,6].

In parallel with demand-side epidemiology, Nigeria maintains an active drug control and interdiction infrastructure. The National Drug Law Enforcement Agency (NDLEA) publishes annual reports and performance summaries describing quantities seized, arrests, and convictions under the War Against Drug Abuse initiative [18,19]. Seizure totals are widely used internationally as core supply-side indicators within drug monitoring frameworks [22,23]. However, seizures are administrative outputs influenced by enforcement intensity, operational targeting, detection capacity, geographic positioning (including borders and ports), trafficking corridors, and reporting practices, rather than direct measures of underlying market size or population exposure [20,21]. International monitoring guidance, therefore, emphasises that seizure data should be interpreted alongside epidemiological estimates and with explicit acknowledgement of uncertainty, incompleteness, and structural drivers of enforcement patterns [22,23].

The concept of geographic alignment provides a structured way to examine the relationship between enforcement activity and estimated drug use burden. In this context, alignment refers to the degree to which the spatial distribution of reported interdiction outputs corresponds with the spatial distribution of survey-estimated users. Such alignment should not be interpreted as a direct measure of enforcement effectiveness or proportionality, as seizures may reflect trafficking flows, port activity, transit dynamics, or concentrated interdiction efforts independent of local consumption patterns. Rather, examining concordance or divergence between supply-side and demand-side indicators offers a systems-level surveillance perspective on the coherence of drug monitoring data streams and may generate hypotheses regarding geographic targeting, data completeness, and structural market dynamics.

Within the broader national landscape of substance use, non-medical use of pharmaceutical opioids has received substantial policy attention. The 2018 national survey highlighted tramadol and codeine-containing preparations among substances of concern [1]. Tramadol's clinical utility as an analgesic has been weighed against misuse potential and its circulation within informal or unregulated markets in West Africa [7,8]. Reports from the World Health Organization Expert Committee on Drug Dependence and toxicology reviews describe dose-related risks including dependence, seizures, and other adverse outcomes [7,9]. Empirical and commentary literature from the region has characterised tramadol as an important contributor to opioid-related harms outside North America [10]. Qualitative and mixed-methods studies in Nigeria describe non-medical prescription drug use for enhancement motivations, including increased energy for work and perceived sexual performance, while noting the influence of price, availability, and informal distribution networks [11,12]. UNODC reporting has further documented cross-border trafficking dynamics in West Africa that may shape national supply patterns independently of household survey–measured demand [13].

Policy attention to pharmaceutical opioid misuse intensified following the widely publicised codeine cough syrup crisis, including investigative reporting and heightened public concern [14]. Federal restrictions on codeine-containing cough syrups and regulatory actions by the National Agency for Food and Drug Administration and Control introduced recalls, shutdowns, and related control measures [15,16]. These developments occurred within the broader framework of Nigeria's National Drug Control Master Plan 2021–2025, which emphasises coordinated, evidence-informed supply reduction, demand reduction, and data strengthening strategies [17]. While pharmaceutical opioids remain salient in public health and regulatory discourse, recent NDLEA reports indicate that cannabis accounts for the majority of total seizure weight nationally in 2021–2022 [18,26]. Consequently, analyses based on total seizure weight are likely to reflect cannabis-dominated interdiction patterns, and substance-specific inference at the zonal level is constrained by available reporting formats.

Despite the availability of a national demand-side baseline and routinely reported enforcement indicators, no prior study has systematically evaluated the geographic correspondence between zonal seizure totals and zonal estimates of drug use burden using a transparent ecological metric. An explicit comparison of these data streams offers a pragmatic opportunity to contextualise enforcement outputs relative to estimated user populations. Such an approach is particularly relevant in data-constrained settings where integrated surveillance systems are evolving and where routine administrative data and periodic surveys constitute the primary sources of monitoring information.

Accordingly, this study examines regional patterns of total drug seizures and survey-estimated drug use burden across Nigeria's six geopolitical zones using publicly available data [1,18,26]. We introduce a seizure-to-user metric constructed to standardise total seizure weight relative to estimated numbers of past-year users, thereby facilitating cross-zonal comparison of interdiction intensity alongside epidemiological burden. By situating administrative enforcement indicators within a demand-side baseline, this ecological analysis aims to generate population-level surveillance signals and inform future data triangulation efforts rather than to infer individual-level causal relationships [24,25]. Through this framework, we seek to contribute to strengthening geographic monitoring and evidence-informed planning within Nigeria's drug control and public health systems.

Methods

Study design and unit of analysis

We conducted a retrospective ecological analysis using publicly available, aggregate indicators of drug seizures and drug use burden in Nigeria [1,2,24,25]. The primary unit of analysis was the geopolitical zone (North Central, North East, North West, South East, South South, and South West), with outcomes summarized by calendar year where year-specific data were available [1,6,18,19,26]. Findings are interpreted as population-level associations and surveillance signals rather than individual-level causal effects [24,25].

Data sources

Drug use burden

Drug use burden estimates (the denominator) were obtained from the *Drug Use in Nigeria 2018* national survey report produced by UNODC in collaboration with Nigerian institutions [1]. We extracted (i) past-year prevalence estimates and (ii) corresponding estimated numbers of users where provided, disaggregated by geopolitical zone [1]. Substance-specific burden measures were extracted for tramadol and codeine where reported as distinct substances, and for broader categories (e.g., pharmaceutical opioids/opiates/any drug use) where only aggregated estimates were available [1].

Drug seizures and enforcement indicators

Drug seizure and enforcement indicators (the numerator) were extracted from the National Drug Law Enforcement Agency (NDLEA) publicly available annual reports and official performance summaries/scorecards [18,19,26]. For each year in the analysis period, we extracted the total quantity of drugs seized and, where reported, substance-specific seizure quantities (including tramadol and codeine) at the national level, as well as enforcement outputs such as arrests and convictions [18,19,26]. Substance-specific seizure quantities were not reported by geopolitical zone in publicly available NDLEA documents; accordingly, zonal analyses were restricted to total seizure weight.

Because seizure data represent an imperfect proxy for drug supply and are influenced by enforcement intensity, operational priorities, detection capacity, trafficking routes, and reporting practices, they were treated as administrative surveillance indicators rather than direct measures of market size [21,27].

Population denominators

Where needed for rate calculations, population denominators were obtained from the National Bureau of Statistics (NBS) demographic publications and related official statistical outputs [6]. Zone-level denominators were used where available; otherwise, analyses were restricted to measures that did not require population denominators (e.g., seizure-to-user ratios using survey-based user estimates) [1,6].

Regulatory and policy context (qualitative support)

To contextualize the enforcement period and opioid-related market dynamics, key national policy and regulatory documents were reviewed, including the Federal Ministry of Health communication on restrictions affecting codeine-containing cough syrups and NAFDAC regulatory alerts/recall communications [15,28]. These sources were used to describe the timing and nature of major regulatory actions (e.g., bans/recalls) that could plausibly influence pharmaceutical opioid availability and enforcement patterns; they were not used as quantitative outcome data [15,28].

Data extraction, coding, and harmonization

Data from each source document were extracted into a standardized spreadsheet with the following minimum fields: year, data source, drug type/category, quantity, unit of measurement (e.g., kg, tonnes, tablets, bottles), and geographic attribution (state and/or geopolitical zone) [6,18,19,26]. Where the same indicator was reported in multiple NDLEA documents for a given year (e.g., annual report vs scorecard), values were cross-checked, and the primary annual report value was retained when discrepancies were not resolvable from the source text [18,19,26].

Geographic attribution was harmonized by mapping state-level mentions to the six geopolitical zones using the zone structure employed in the UNODC national survey reporting [1]. If a seizure/enforcement metric was reported only at the national level, it was retained as a national-only observation and excluded from zone-level comparative calculations [18,19,26].

Units were harmonized as follows: quantities reported in tonnes were converted to kilograms (1 tonne = 1,000 kg). For pharmaceutical seizures reported as tablet/bottle counts rather than mass, counts were retained as reported for descriptive summaries. Where conversion to mass was required for sensitivity analyses, conversions were based on labeled strength information when explicitly stated in the source document; however, no such conversions were required for the reported zonal analyses, as seizure weights were analysed in aggregate form; otherwise, no conversion was applied, and results were presented in original units to avoid introducing unverified assumptions [18,19,26].

Missing values were treated as "not reported" (i.e., absence of a value in a source document was not interpreted as zero seizures) [1,18,19,26]. Data extraction was conducted by one reviewer and cross-checked against source tables to ensure consistency and accuracy.

Measures and derived indicators

Primary outcomes

Primary outcomes were:

1. NDLEA-reported quantities of drugs seized (total and substance-specific where available), by year and geopolitical zone [18,19,26].
2. UNODC survey-based estimates of past-year drug use burden (prevalence and/or estimated number of users) by geopolitical zone [1].

Total Seizure-to–Any-Drug-User Ratio (TSUR)

To evaluate alignment between enforcement intensity and burden distribution, we calculated a Total Seizure-to–Any-Drug-User Ratio (TSUR) by geopolitical zone. TSUR was defined as:

TSUR = (total drug seizures in kilograms for a given zone and year) / (estimated number of past-year any-drug users in that zone, derived from the 2018 national survey).

For interpretability, TSUR values were scaled and reported as kilograms seized per 1,000 estimated users [1,6,18,19,26]. The TSUR standardises total seizure weight relative to estimated numbers of past-year users within each zone, thereby providing a comparable indicator of reported interdiction intensity in relation to a demand-side baseline. Because total seizure weight in 2021–2022 was dominated by cannabis at the national level, TSUR primarily reflects cannabis-weight–dominated interdiction patterns in these years and should not be interpreted as a substance-specific enforcement metric. Where seizures were only available as counts (e.g., tablets), an analogous "count-per-1,000-users" metric was reported as a secondary descriptive indicator rather than forcing conversion to kilograms [18,19,26].

Statistical analysis

Analyses were descriptive and ecological. Zone-level distributions of drug use burden and seizure indicators were summarized using totals, rates (where denominators were available), and rank order comparisons [1,6,18,19,26]. Associations between zone-level seizure intensity and zone-level burden were assessed using non-parametric correlation (Spearman's rho), given the small number of zones and non-normal distributions [24,25].

Given the small number of geopolitical zones (n = 6), correlation analyses were treated as exploratory. For each year, we report Spearman's ρ, exact two-sided permutation p-values, and approximate 95% confidence intervals calculated using standard rank-correlation methods. Confidence intervals are presented as approximate, given the small sample size and should be interpreted cautiously. Results are described as patterns of concordance or divergence rather than confirmatory statistical inference.

No adjustment for confounding was undertaken because the analysis used aggregate zonal indicators and was intended to describe population-level patterns rather than estimate causal effects. No imputation was performed; analyses were based solely on publicly reported aggregate data, and no missing zonal values were identified in the extracted indicators.

Sensitivity analysis for denominator drift (±10–20%)

To evaluate robustness to temporal mismatch between the 2018 survey denominator and 2021–2022 seizure numerators, we conducted a sensitivity analysis assuming plausible changes in zonal prevalence of ±10% and ±20%. These bounds were selected to represent conservative and moderate shifts in regional drug use prevalence over a 3–4 year period in the absence of updated nationally representative zonal estimates. For each zone, TSUR values were recalculated under these alternative denominator scenarios, and the rank ordering of zones was compared with baseline estimates to assess stability of geographic patterns. This approach provides an assessment of the extent to which conclusions regarding alignment are sensitive to plausible changes in underlying prevalence.

All analyses were conducted using spreadsheet-based calculations and reproducible scripts (where applicable), with all key derived measures (including TSUR) computed directly from extracted values [1,6,18,19,26].

Ethics

This study used only publicly available, aggregated data and did not involve human participants, individual-level records, or identifiable private information. As such, institutional ethics review was not required [1,24].

Results

Data availability and completeness

Demand-side estimates, including past-year prevalence and estimated numbers of users by geopolitical zone, were obtained from the 2018 national drug use survey tables [1]. Although cannabis dominates seizure weight in recent NDLEA reports, opioids and other pharmaceuticals remain a key policy focus in Nigeria; this analysis, therefore, examines total seizures while interpreting substance-specific implications cautiously. Supply-side indicators, including total drug seizures, arrests, and convictions by geopolitical zone, were available from NDLEA Annual Reports for 2021 and 2022, which present zonal summary tables for these indicators [18,26]. National seizure composition by selected drug types (by weight) was available from interdiction summaries in the NDLEA 2021 and 2022 reports [18,26].

Drug use burden by geopolitical zone

Zonal estimates of past-year any drug use, opioid use, and pharmaceutical opioid use are summarised in Table 1 [1].

Past-year any drug use prevalence ranged from 10.0% in North Central (1.50 million users) to 22.4% in South West (4.38 million users) [1]. In absolute terms, the largest estimated numbers of past-year drug users were observed in the South West (4.38 million) and North West (3.00 million) zones [1].

For opioids, zonal prevalence ranged from 1.1% in North Central (164,000 users) to 7.9% in South West (1.54 million users) [1]. A similar geographic pattern was observed for pharmaceutical opioids, with prevalence ranging from 1.1% in North Central (160,000 users) to 7.8% in South West (1.53 million users) [1].

Table 1. Past-year drug use burden by geopolitical zone (Nigeria, 2018) [1]

Zone	Any drug use (%)	Any drug users (estimated)	Opioids (%)	Opioid users (estimated)	Pharmaceutical opioids (%)	Pharmaceutical opioid users (estimated)
North Central	10.0	1500000	1.1	164000	1.1	160000
North East	13.6	2090000	6.6	1013000	6.5	1000000
North West	12.0	3000000	2.7	690000	2.7	670000
South East	13.8	1550000	3.2	360000	3.1	352000
South South	16.6	2124000	3.3	428000	3.2	411000
South West	22.4	4382000	7.9	1540000	7.8	1530000

National seizure totals and drug-type composition

NDLEA seizures, arrests and convictions (2021–2022)

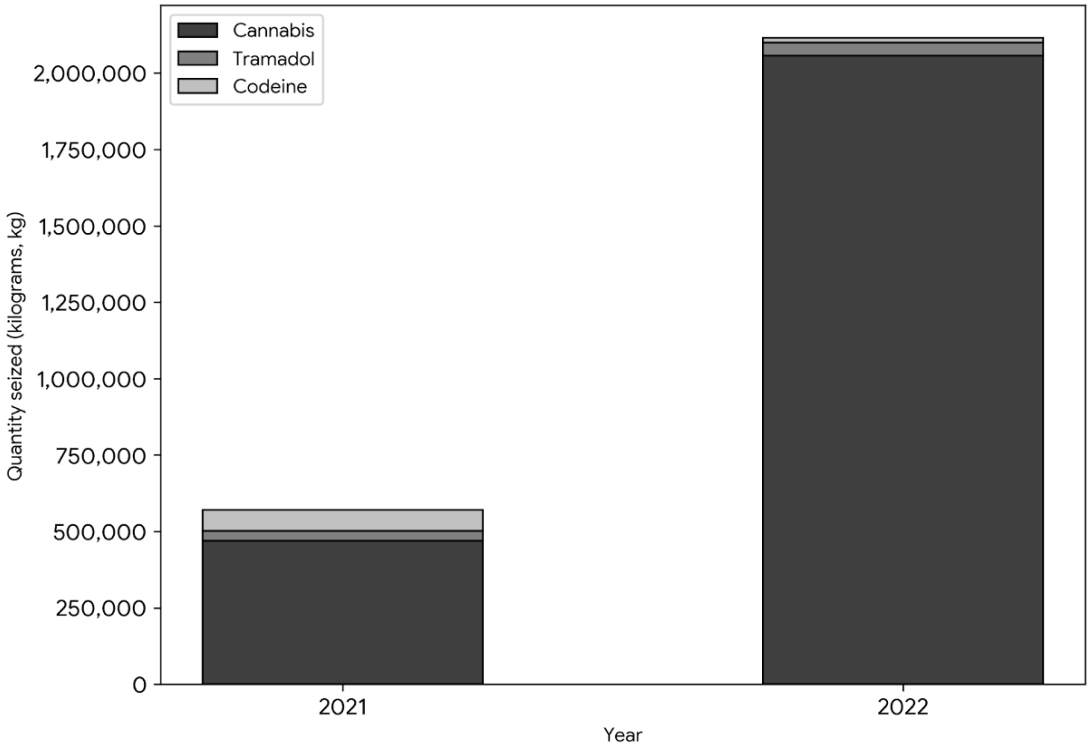
Total seized drug weight increased from approximately 580,000 kg in 2021 to 2.15 million kg in 2022 [18,26]. Across both years, cannabis constituted the dominant share of seizure weight, increasing from 80.9% in 2021 to 95.9% in 2022 [18,26]. Tramadol accounted for approximately 5.6% of seizure weight in 2021 and 2.0% in 2022, while codeine accounted for 11.8% in 2021 and 0.7% in 2022 [18,26].

These national patterns are presented in Table 2 and visualised in Figure 1.

Table 2. National seizure totals and selected drug-type composition (2021–2022) [18,26]

Year	Total seized (kg)	Cannabis (kg)	Cannabis (%)	Tramadol (kg)	Tramadol (%)	Codeine (kg)	Codeine (%)
2021	580377.43	469246.40	80.85	32709.43	5.64	68198.98	11.75
2022	2145336.30	2057020.05	95.88	42808.48	2.00	15858.21	0.74

National composition of NDLEA drug seizures by weight, Nigeria (2021–2022)



Data source: National Drug Law Enforcement Agency (NDLEA) Annual Reports 2021 and 2022.

Figure 1. National composition of NDLEA drug seizures by weight for selected drug types, Nigeria (2021–2022) [18,26].

Stacked bars show the proportional contribution of cannabis, tramadol, and codeine to total drug seizures (kg) reported nationally for each year. Data derived from NDLEA Annual Reports 2021 and 2022 [18,26]. Other substances not shown account for the remaining proportion of total seizure weight.

Zonal distribution of seizure quantities

In 2021, zonal seizure totals were highly concentrated in the South South (52.6%) and South West (37.5%), together accounting for approximately 90% of total seizure weight [18]. In 2022, this concentration persisted, with the South West (62.3%) and South South (27.8%) jointly accounting for approximately 90% of total seizure weight [26].

Zonal seizure quantities and proportional shares for both years are presented in Table 3.

Table 3. Total drug seizures by geopolitical zone (kg and % of national total), 2021–2022 [18,26]

Zone	2021 (kg)	2021 share (%)	2022 (kg)	2022 share (%)
North Central	20737.94	3.57	156862.15	7.31
North East	9165.45	1.60	7226.57	0.34
North West	18933.20	3.26	42799.51	2.00
South East	8799.84	1.52	6103.52	0.28
South South	305390.27	52.62	596686.67	27.81
South West	217342.17	37.45	1335657.88	62.26
Total	**580368.87**	**100**	**2145336.30**	**100**

Footnote: Minor differences between national totals and the sum of zonal totals may occur due to NDLEA reporting practices and rounding across summary tables [18,26].

Arrests, convictions, and enforcement output patterns

Arrests and convictions by geopolitical zone for 2021 and 2022 are summarised in Table 4.

The NDLEA reported 12,306 arrests in 2021, increasing to 14,152 arrests in 2022 [18,26]. Arrests were highest in the North West in both years (3,144 in 2021; 4,367 in 2022) [18,26].

Convictions increased from 1,385 in 2021 to 2,348 in 2022 [18,26]. The highest numbers of convictions were recorded in North Central in both years (345 in 2021; 549 in 2022), with the South West also contributing substantially in 2022 (484) [18,26].

When considered alongside TSUR patterns, the divergence between seizure weight and arrest and conviction totals further underscores that different enforcement outputs may reflect distinct operational processes rather than a single dimension of enforcement intensity.

Table 4. Arrests and convictions by geopolitical zone, 2021–2022 [18,26]

Zone	Arrests 2021	Arrests 2022	Convictions 2021	Convictions 2022
North Central	2283	2716	345	549
North East	1943	2072	196	305
North West	3144	4367	288	388
South East	1256	952	183	304
South South	1502	1713	146	318
South West	2178	2332	227	484
Total	**12306**	**14152**	**1385**	**2348**

Total Seizure-to–Any-Drug-User Ratio (TSUR) and alignment of seizures with drug use burden

Using zonal estimates of past-year any drug users (2018) as denominators [1], the **Total Seizure-to–Any-Drug-User Ratio (TSUR; kilograms seized per 1,000 estimated users)** varied markedly across zones in both 2021 and 2022 (Figure 2) [18,26].

In 2021, TSUR ranged from 4.4 kg per 1,000 users in the North East to 143.8 kg per 1,000 users in the South South [1,18]. In 2022, TSUR ranged from 3.5 kg per 1,000 users in the North East to 304.8 kg per 1,000 users in the South West [1,26].

Comparisons of each zone's share of total seizures with its share of estimated drug users indicated marked variation across zones. Seizure shares exceeded user shares most prominently in the South South in 2021 and in the South West in 2022, whereas the North East and South East consistently accounted for smaller seizure shares relative to their estimated user shares [1,18,26].

Across the six zones, the association between total seizure quantity (kg) and estimated numbers of past-year drug users was positive but statistically unstable in both years (2021: Spearman's $\rho = 0.43$, exact two-sided permutation $p = 0.419$, approximate 95% confidence interval −0.59 to 0.92; 2022: $\rho = 0.54$, exact $p = 0.297$, approximate 95% confidence interval −0.48 to 0.94; $n = 6$ zones) [1,18,26]. Given the small number of aggregate units, confidence intervals were wide and encompassed negative values, indicating substantial statistical uncertainty. These correlations are therefore presented as exploratory surveillance signals rather than confirmatory evidence of geographic concordance.

Sensitivity analyses assuming ±20% proportional changes in zonal user estimates resulted in corresponding shifts in TSUR values but did not materially alter the overall geographic pattern (Table 5). South South and South West remained the zones with the highest TSUR values in both years under all ±20% scenarios. In 2022, the relative ranking between South West and South South remained concentrated at the top and varied modestly depending on denominator assumptions, while other zones maintained substantially lower TSUR values.

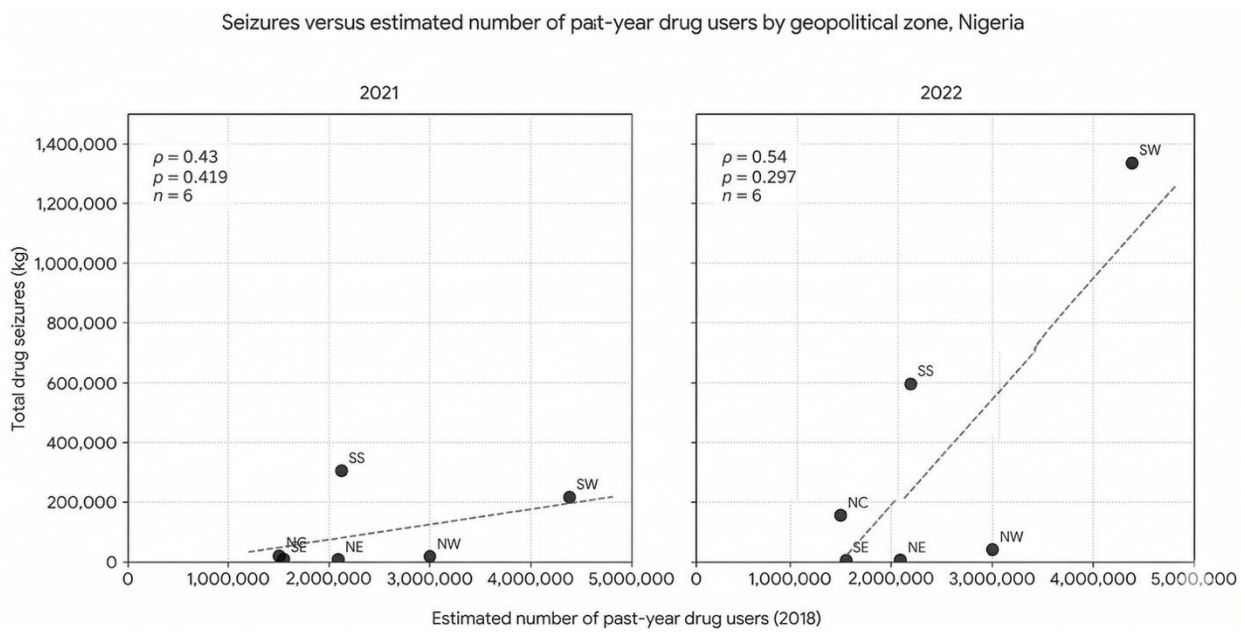
Table 5. Total Seizure-to–Any-Drug-User Ratio (TSUR) by geopolitical zone under baseline and denominator sensitivity assumptions (±20%), Nigeria 2021–2022

Zone	2021 TSUR (baseline)	2021 TSUR (+20% users)	2021 TSUR (−20% users)	2022 TSUR (baseline)	2022 TSUR (+20% users)	2022 TSUR (−20% users)
North Central	13.83	11.52	17.29	104.57	87.14	130.71
North East	4.39	3.66	5.49	3.46	2.88	4.33
North West	6.31	5.26	7.89	14.27	11.89	17.84
South East	5.68	4.73	7.11	3.94	3.28	4.92
South South	143.78	119.82	179.73	280.93	234.11	351.16
South West	49.60	41.33	62.00	304.81	254.01	381.01

Footnote (include below table)

TSUR values are expressed as kilograms seized per 1,000 estimated past-year any-drug users. Baseline denominators are derived from the 2018 national drug use survey [1]; seizure numerators are derived from NDLEA Annual Reports 2021–2022 [18,26]. Sensitivity scenarios assume ±20% proportional changes in zonal user estimates to assess robustness to temporal mismatch between survey and enforcement years.

Collectively, the observed variation in TSUR and the statistically imprecise correlations suggest that enforcement activity does not uniformly correspond to the regional distribution of estimated drug use burden and that geographic alignment is partial and heterogeneous across zones.



Data source: UNODC 2018 (Users), NDLEA Annual Reports 2021/2022 (Seizures). Axes scaled identically across panels for comparability.

Figure 2. Relationship between total drug seizures and estimated number of past-year drug users by geopolitical zone in Nigeria.

Scatter plots show zonal totals of drug seizures (kg) reported by the NDLEA in 2021 and 2022 plotted against estimated numbers of past-year drug users derived from the 2018 national drug use survey. Each point represents one geopolitical zone. Axes are scaled identically across panels for comparability. The figure illustrates population-level alignment or mismatch between enforcement activity and estimated drug use burden without implying causality [1,18,26]. Spearman's ρ and exact p-values are shown within each panel; approximate 95% confidence intervals are reported in-text. Associations are interpreted as exploratory given the small number of zones (n = 6).

Discussion

This retrospective ecological analysis combined a national demand-side baseline from the 2018 Nigerian drug use survey with supply-side administrative indicators from NDLEA Annual Reports (2021–2022) to describe how reported seizures and enforcement outputs align with the regional distribution of drug use burden [1,18,26]. Three findings stand out. First, the 2018 survey indicated substantial geographic heterogeneity in past-year drug use burden, with the South West showing the highest estimated number of past-year drug users and the North West also contributing a large absolute burden [1]. Second, NDLEA-reported seizure weight increased markedly from 2021 to 2022, and national seizure composition in both years was dominated by cannabis by weight (Figure 1) [18,26]. Third, zonal seizure totals were highly concentrated in the South South and South West, and the derived Total Seizure-to–Any-Drug-User Ratio (TSUR) varied by more than an order of magnitude across zones (Figure 2), indicating substantial geographic variation in seizures relative to estimated user populations [1,18,26].

From a surveillance perspective, examining the degree of geographic concordance between enforcement intensity and estimated burden provides insight into how supply-side indicators and demand-side estimates intersect spatially. Perfect concordance would not be expected given trafficking dynamics, port and border activity, operational targeting, and resource constraints. Substantial divergence, therefore, does not necessarily imply inefficiency, but may instead reflect structural features of drug markets and interdiction strategies that are not captured by household survey–based burden estimates.

Alignment and mismatch between burden and seizures

At the zonal level, the South West exhibited both the highest estimated user burden (2018) and the highest seizure weight (particularly in 2022), suggesting partial alignment between demand-side burden and supply-side interdiction intensity in this zone [1,26]. By contrast, the South South accounted for a disproportionately large share of seizure weight relative to its estimated share of drug users in 2018, particularly in 2021, consistent with a pattern in which seizure totals may reflect concentrated interdiction activity, local supply conditions, trafficking dynamics, port access, transit routes, or reporting practices beyond local household survey–based burden [1,18,26]. These patterns are consistent with international drug monitoring guidance emphasising that seizures are an important supply-side indicator but are shaped by enforcement intensity and operational priorities and should be interpreted alongside other data streams [21–23,27]. Seizure totals may also reflect trafficking routes, border and port activity, cultivation patterns, and operational enforcement priorities, in addition to local demand.

The positive but statistically unstable zone-level correlations observed between seizure weight and estimated numbers of users (Figure 2) further support the interpretation that seizure quantities and drug use burden are related at a broad geographic scale but are not tightly coupled [1,18,26]. Given the small number of geopolitical zones (n = 6), confidence intervals were wide and encompassed negative values, underscoring the exploratory nature of these associations**.** In an ecological framework, such imperfect alignment is expected, particularly when the numerator and denominator derive from different systems (administrative enforcement reporting versus household survey estimation) and when the analytic unit is coarse (six geopolitical zones) [24,25].

National seizure composition and implications for interpretation

Nationally, cannabis comprised the largest proportion of seized weight in both 2021 and 2022, with an increased dominance in 2022 (Figure 1) [18,26]. This has two implications for interpretation. First, total seizure weight—and therefore the zonal seizure totals used in the **TSUR** and Figure 2—are likely driven primarily by cannabis seizures by weight [18,26]. Second, while pharmaceutical opioids remain a key public health concern in Nigeria (including tramadol and codeine-related harms described in the national survey and related literature) [1,7,9,10], the available NDLEA weight-based composition indicates that pharmaceutical opioids constitute a smaller fraction of national seizure weight than cannabis in these two years [18,26]. The observed year-to-year changes in tramadol and codeine shares should be interpreted cautiously; changes may reflect shifts in supply, enforcement targeting, detection capacity, or reporting practices rather than true changes in market size [21–23,27]. Regulatory actions and public attention to codeine-containing cough syrups since 2018 provide important policy context, but this study does not support causal attribution of composition changes to any single policy measure [15,16,22,23,28].

Enforcement outputs beyond seizures

Patterns in arrests and convictions did not mirror seizure weight patterns perfectly [18,26]. Together, seizure weight, arrests, and convictions represent related but non-equivalent enforcement outputs that may capture different segments of drug market activity and judicial processing. For example, arrests were highest in the North West in both years despite comparatively low seizure weight in that zone, whereas the South South and South West dominated seizure weight [18,26]. This divergence is consistent with the possibility that seizures (particularly by weight) may be driven by relatively few large interdictions, while arrests and convictions may reflect higher-volume, smaller-scale enforcement activity [18,26]. More broadly, criminal justice outputs are shaped by legal processes, prosecutorial capacity, case mix, and enforcement priorities, and should not be interpreted as direct proxies for the underlying size of drug markets or population exposure [20,21].

Value of TSUR as a surveillance metric

The **TSUR** provides a transparent, reproducible metric to contextualise seizures relative to estimated user burden at a population level, without implying individual-level effects [1,24,25]. In settings where routine public health surveillance of substance use and harms is limited, combining a national survey baseline with routinely reported enforcement outputs can generate useful signals for planning, hypothesis generation, and prioritisation of data improvements [1,17,22,23]. For example, zones with low seizure share relative to estimated user share may warrant closer assessment of enforcement coverage, reporting completeness, and complementary indicators (e.g., treatment demand, hospital presentations, sentinel community surveillance), whereas zones with very high seizure share relative to estimated user share may reflect concentrated interdiction activity that merits triangulation with contextual information [1,18,22,23,26,27]. By combining routinely reported administrative data with survey-based estimates, the **TSUR** offers a pragmatic and transparent approach for population-level surveillance in settings with limited data availability. The Total Seizure-to–Any-Drug-User Ratio is intended as a contextual surveillance metric to support interpretation of enforcement activity alongside epidemiological estimates, rather than as a measure of enforcement performance or effectiveness.

As a metric derived from routinely reported administrative and survey data, the **TSUR** may be particularly relevant for other low- and middle-income settings where comprehensive real-time drug surveillance systems are not yet established. Integrating supply-side and demand-side indicators in this manner offers a scalable approach to strengthening drug policy monitoring frameworks.

Strengths

This study used publicly available sources and a pre-specified ecological framework, with transparent construction of the numerator (seizure weight by zone) and denominator (survey-estimated users by zone) and conservative interpretation consistent with ecological methods guidance [1,18,24–26]. The use of geopolitical zones also supports interpretability for national planning and aligns with published analyses demonstrating meaningful geographic clustering of drug use in Nigeria [2].

Limitations

Several limitations should be considered. First, as an ecological analysis, findings are vulnerable to ecological bias and cannot be interpreted as individual-level associations or causal effects [24,25]. Second, the demand-side denominator is derived from the 2018 national survey, while the seizure numerators are from 2021–2022; changes in drug use patterns between 2018 and 2021–2022, including potential COVID-19–related shifts, could contribute to apparent mismatches [1,18,26]. Although more recent nationally representative survey data with zonal disaggregation would strengthen contemporaneous comparison, the 2018 survey remains the most recent available source for population-level drug use estimates in Nigeria. Third, NDLEA seizure data are administrative indicators influenced by enforcement intensity, targeting, detection capacity, and reporting practices; seizure totals are therefore not direct measures of market size or population exposure [18,21–23,26,27]. Fourth, zonal seizure totals by year were only available in the NDLEA reports for 2021 and 2022, limiting the temporal scope of zonal comparisons and preventing assessment of longer-term trends [18,26]. Fifth, TSUR uses estimated numbers of "any drug users" as the denominator and total seizure weight as the numerator; given that total seizure weight is dominated by cannabis in these years, the TSUR may primarily reflect cannabis-related interdiction intensity rather than substance-specific alignment (e.g., pharmaceutical opioids) [1,18,26]. Finally, household survey estimates may under-represent some high-risk or institutionalised populations and rely on self-report, which may lead to underestimation of use in some contexts; such measurement error could vary geographically [1].

The 2018 survey remains the most recent nationally representative source providing zonal disaggregation of drug use in Nigeria; accordingly, TSUR estimates are intended for contextualisation rather than causal inference. In the absence of more recent nationally representative survey data with zonal disaggregation, the 2018 survey provides the best available baseline for contextual ecological comparison with subsequent enforcement indicators.

Conclusions

Using a national survey baseline and NDLEA administrative indicators, this ecological analysis demonstrates substantial geographic variation in both drug use burden and enforcement activity across Nigeria's geopolitical zones [1,18,26]. Although partial alignment was observed in some zones, seizures were disproportionately concentrated in others relative to estimated user burden, indicating that enforcement activity does not uniformly correspond to the regional distribution of demand-side burden indicators [1,18,26]. Nationally, cannabis dominated seizure weight in both 2021 and 2022 [18,26].

The Total Seizure-to–Any-Drug-User Ratio (TSUR) provides a pragmatic, transparent metric for contextualising enforcement activity relative to estimated user populations and may serve as a population-level surveillance signal when interpreted cautiously and alongside complementary indicators [1,22,23,27]. Integrating such supply-side and demand-side indicators can strengthen geographic targeting, surveillance prioritisation, and evidence-informed planning within Nigeria's drug control framework. Continued triangulation with health system, treatment, and market data will be important to enhance routine monitoring and support more coherent drug policy implementation in line with national objectives [17,22,23].

Declarations

Ethics approval and consent to participate

Not applicable. This study used publicly available, aggregate secondary data and did not involve human participants.

Consent for publication

Not applicable.

Availability of data and materials

All data used in this study are publicly available from the United Nations Office on Drugs and Crime (UNODC), the National Drug Law Enforcement Agency (NDLEA), and the National Bureau of Statistics (Nigeria), as cited in the manuscript.

Competing interests

The authors declare that they have no competing interests.

Funding

This study received no external funding. The authors conducted this work as part of independent academic and clinical scholarship.

Acknowledgements
The authors acknowledge the National Drug Law Enforcement Agency (NDLEA), the United Nations Office on Drugs and Crime (UNODC), and the National Bureau of Statistics (Nigeria) for making aggregate data publicly available, enabling independent analysis. The views expressed are those of the authors and do not necessarily reflect those of the data-providing institutions.

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