

Measurement of opioid misuse in the general Mexican population: Encodat 2025

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Abstract

Objective. To examine the prevalence of categorical self-reported opioid misuse and compare it to a post hoc corrected indicator in the general Mexican population. **Materials and methods.** We used data from the 2025 *Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco*. We constructed indicators from self-reported categorical heroin/fentanyl use, prescription opioids misuse and opioid misuse and post hoc corrected versions based on the review of open-ended follow up questions by two experts. We estimated the prevalence from categorical self-report responses and compared it with the post hoc corrected indicators. **Results.** The prevalence of self-reported prescription opioid misuse was 1 948.3 per 100 000 people, which decreased to 1 242.4 after correction. Self-reported heroin or fentanyl use was 370.7 per 100 000 people, with a corrected prevalence of 326.2. Self-reported opioid misuse had a prevalence of 2 229.6 per 100 000 people, which decreased to 1 482.3 after correction. **Conclusion.** Misclassification was more frequent for prescription opioid misuse than for illicit opioid use. Simple categorical questions performed well for measuring illicit opioid use, but they moderately overestimated prescription and overall opioid misuse.

Keywords: opioids; prevalence; self-reported opioid misuse; population-based survey; Mexico

Resumen

Objetivo. Examinar la prevalencia de variables categóricas autorreportadas de uso indebido de opioides, y compararlas con corrección post hoc, en la población general mexicana. **Material y métodos.** Se utilizaron datos de la Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco 2025. Se construyeron indicadores de preguntas categóricas autorreportadas y con corrección post hoc basado en la revisión de preguntas abiertas por dos personas expertas. Se estimaron y compararon las prevalencias de los indicadores categóricos autorreportados y los corregidos post hoc. **Resultados.** La prevalencia del uso indebido de opioides autorreportado fue 1 948.3 por 100 000 personas, la cual disminuyó a 1 242.4 después de la corrección. El uso autorreportado de heroína o fentanilo fue 370.7 por 100 000 personas, con una prevalencia corregida de 326.2. El uso indebido de opioides autorreportado tuvo una prevalencia de 2 229.6 por 100 000 personas, la cual disminuyó a 1 482.3 después de la corrección. **Conclusión.** La clasificación incorrecta fue más frecuente en opioides médicos usados fuera de prescripción que en opioides ilícitos. Las preguntas categóricas mostraron un buen desempeño para medir el uso de opioides ilícitos, pero sobreestimaron moderadamente opioides médicos usados fuera de prescripción y uso indebido de opioides.

Palabras clave: opioides; prevalencia; abuso de opioides; encuesta epidemiológica; México

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Opioid misuse is defined as either the use of legal opioids outside of medical prescription or the use of illicit opioids.¹ It is considered an emerging public health concern in Mexico.^{2,3} Historically, national opioid misuse has remained low, but dynamic factors such as migration, shifts in supply, marginalization and violence are causing a transition in the northern areas of the country.⁴ In Mexico, opioids approved for medical use include tramadol, morphine, codeine, buprenorphine, fentanyl, nalbuphine, propoxyphene, meperidine, and pentazocine, among others. The most widespread illicit opioids in Mexico's street drug market are heroin, illicitly manufactured fentanyl and a mix of both.⁴ The magnitude of opioid misuse is difficult to assess in the country, due to limited information on overdoses and marginalization of people who misuse opioids.^{5,6}

Measuring population-level opioid misuse is a challenge for public health surveillance. Representative household surveys are the most widely used tool to estimate national opioid misuse prevalence. A major obstacle in these surveys is response bias, which can arise from social desirability, cognitive impairment, or survey design.⁷⁻⁹ Regarding survey design, to measure opioid misuse prevalence, a questionnaire must contain at minimum two questions: one for prescription opioid misuse and another for illicit opioid use. These two questions are then combined to construct the opioid misuse indicator. Several countries, including Argentina and Chile, have implemented this approach, using two categorical questions.^{10,11}

Evidence on how survey questions influence opioid misuse prevalence estimates on population-wide surveys is limited. A reduced set of questions may increase response bias and overestimate misuse prevalence. A 2013 Canadian study showed that measuring past-year prescription opioid misuse with one question, compared to two, yielded a national prevalence estimate three times higher.⁷ To tackle this, questionnaires can be extended. For instance, the United States' National Survey on Drug Use and Health (NSDUH) constructs its opioid misuse indicator using approximately 20 questions, including showcards.¹² A noteworthy constraint is that each additional question increases the financial burden for countries designing their surveys.¹³

Mexico's 2025 *Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco* (Encodat) measured lifetime opioid misuse through seven questions.¹⁴ It used two categorical and one follow-up open-ended question for prescription opioid misuse, and two categorical and two follow-up open-ended questions for illicit opioid use. The three open-ended follow-up questions were used to do *post hoc* correction to improve the accuracy of the indicators.¹⁴ This approach was the same for all drug

classes in the survey, and was rooted in maintaining historical comparability and containing costs while keeping accuracy. However, recent research has suggested that opioids pose added challenges than other drugs when measured in national surveys.¹⁵ The Encodat design offers a unique opportunity to examine opioid misuse measurement through self-reported categorical questions which have been relied on in resource-constrained national surveys, and compare them with the *post hoc* corrected variables. Thus, the objective of this study was to examine the prevalence of opioid misuse in the general Mexican population from categorical self-reported opioid misuse and compare it with a *post hoc* corrected indicator using a ratio of the categorical questions and the corrected indicator.

Materials and methods

Data source/study population

We used data from the Encodat 2025, a nationally representative household survey of drug, alcohol and tobacco use among the Mexican population aged 12 to 65 years. Encodat used multistage probability sampling designed to be representative at the national, regional, and urban/rural levels. Complete methodological details, including sampling procedures and fieldwork have been described previously.¹⁶

Self-report variables

Opioid misuse was defined following the NSDUH's definition as prescription opioids misuse or heroin use.¹ We also included fentanyl, as reports show that fentanyl is more widely used than heroin in the Mexican illicit drug market.^{2,17}

First, we constructed a binary indicator (yes/no) for prescription opioid misuse using two sequential categorical questions. Respondents were first asked whether they had ever used or tried opioids or medications for severe pain (e.g., tramadol, morphine, codeine, buprenorphine, fentanyl, among others). Those who responded yes were then asked whether their use was without a prescription or differently than prescribed. Respondents were classified as engaging in prescription opioid misuse if they reported both lifetime opioid use and non-prescribed use or use different from prescribed.

Second, we constructed a binary indicator (yes/no) for "heroin/fentanyl use" from two categorical questions. Respondents were asked separately whether they had ever used or tried heroin or fentanyl. Third, we constructed a binary (yes/no) "opioid misuse" indicator, classified as *yes* if respondents reported either

“prescription opioids misuse” or “heroin/fentanyl use”, or *no* if neither. The exact questions and their English translations are available in supplementary table S1.¹⁸

Post hoc corrected variables

Surveyed individuals who responded *yes* to each substance use question were then asked to name the prescription medication or drug that they were reporting. Up to two names per question were written down verbatim by fieldwork personnel. In the official survey report, these open-ended questions were used to perform *post hoc* correction to improve the accuracy of the indicators. On the final survey dataset, these verbatim names were registered as strings. Specifically for this article, we processed the final survey dataset, independently from the official report. First, we compiled the full list of reported drugs, cleaned typos, corrected misspellings, and disaggregated substances of combined commercial formulations when applicable. The full list contained 107 substances and substance combinations for prescription opioids and 26 names for illicit opioids (supplementary tables S2 and S4).¹⁸

Then, two expert substance use researchers independently reviewed the full list of compiled names and flagged those that were incorrectly self-reported, that is, those that were reported as opioids by interviewees, but which, upon review, were not opioids. Experts reached 100% (107/107) agreement on reported prescription opioids and 92% agreement (24/26) on illicit opioids.

We constructed corrected versions of “prescription opioids misuse”, “heroin/fentanyl misuse” and “opioid misuse”, by reclassifying observations with flagged names by the two experts from *yes* to *no*. We considered the two disagreements on illicit opioids as “Not opioids” to be conservative in estimates. Full names and their *post hoc* correction are shown in tables S3 and S4 of the supplementary material.¹⁸

Statistical analysis

We estimated weighted prevalence estimates and 95% confidence intervals (95%CI) for self-reported and *post hoc* corrected prescription opioid misuse, heroin or fentanyl use, and opioid misuse. We compared the categorical questions and the post-hoc corrected variables, for “prescription opioids misuse”, “heroin/fentanyl use” and “opioid misuse” with a ratio as: $Ratio = (Self-reported\ opioids) / (Correctly\ reported\ opioids)$, where *Self-reported opioids* was those that self-reported as people who used opioids using the categorical questions, and *Correctly reported* was those that were confirmed as in their opioid use by the *post hoc* variable. All data processing and

estimates were undertaken using Stata version 17 (College Station, Texas).

Ethical considerations

The Encodat 2025 protocol was reviewed and approved by the Research, Biosafety and Ethics Committees of the *Instituto Nacional de Salud Pública* (INSP) (IC registration: 1967).

Results

Table I shows the prevalence of prescription opioid misuse, heroin or fentanyl use, and opioid misuse from the self-reported and corrected indicators. The prevalence of self-reported prescription opioid misuse was 1 948.3 per 100 000 people (95%CI: 1 682.0, 2 255.8), which decreased to 1 242.4 per 100 000 people (95%CI: 1 046.2, 1 474.9) after correction. Self-reported heroin or fentanyl use was 370.7 per 100 000 people (95%CI: 237.0, 579.6), with a corrected prevalence of 326.2 per 100 000 people (95%CI: 199.7, 532.6). Overall, self-reported opioid misuse had a prevalence of 2 229.6 per 100 000 people (95%CI: 1 922.2, 2 584.9), which decreased to 1 482.3 per 100 000 people (95%CI: 1 244.6, 1 764.7) after correction.

Table II shows the ratio of self-reported prescription opioid misuse, heroin/fentanyl use, and opioid misuse compared with the *post hoc* substance use correction. For prescription opioid misuse, 409 individuals self-reported misuse, with 144 incorrectly reported and 265 correctly reported, yielding a ratio of 1.54. For heroin or fentanyl use, 65 individuals self-reported use, with 10 incorrectly reported and 55 correctly reported, yielding

Table I
PREVALENCE OF SELF-REPORTED AND CORRECTED LIFETIME OPIOID MISUSE IN MEXICO. ENCODAT 2025

Variable	Prevalence per 100 000 people (95%CI) [n= 19 200, N= 92.6 M]	
	Self-reported	Corrected
Prescription opioid misuse	1 948.3 (1 682.0, 2 255.8)	1 242.4 (1 046.2, 1 474.9)
Heroin or fentanyl use	370.7 (237.0, 579.6)*	326.2 (199.7, 532.6)*
Opioid misuse	2 229.6 (1 922.2, 2 584.9)	1 482.3 (1 244.6, 1 764.7)

*Variation coefficient >15 & <30

Encodat: Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco

95%CI: 95% confidence interval;

n= sample size, N=Expanded sample size.

Table II
RATIO OF SELF-REPORTED VS POST HOC CORRECTION
FOR HEROIN/FENTANYL USE, PRESCRIPTION
OPIOIDS MISUSE AND OPIOID MISUSE.
MEXICO, ENCODAT 2025

Measurement	Self-reported	Post hoc correction		Ratio
		Incorrectly reported	Correctly reported	
Prescription opioids misuse	409	144	265	1.54
Heroin or fentanyl use	65	10	55	1.18
Opioid misuse	462	152	310	1.49

Overestimation: Self-reported opioids/correctly reported opioids;
 Encodat: Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco

a ratio of 1.18. For opioid misuse, 462 individuals self-reported misuse, with 152 incorrectly reported and 310 correctly reported, yielding a ratio of 1.49.

Discussion

This study examined the prevalence of opioid misuse measures and compared self-reported to *post hoc* corrected indicators in a nationally representative sample of the Mexican population aged 12 to 65 years. The prevalence estimates per 100 000 people (370.7 self-reported vs 326.2 corrected, ratio=1.18) for heroin or fentanyl use suggest that a minimum set of categorical questions measure illicit opioid use adequately. However, the prevalence for prescription opioid misuse per 100 000 people (1 948.3 self-reported vs. 1 242.4 corrected, ratio= 1.54) and opioid misuse (2 229.6 self-reported vs. 1 482.3 corrected, ratio= 1.49) are likely to be moderately overestimated if measured with simple categorical questions. These findings are particularly relevant for the Latin American setting, where opioid misuse is increasingly recognized as a public health emergency and resources to expand data collection may be limited.¹⁹⁻²¹ These results should be considered jointly with other sources of response bias, as well as potential selection bias, which could be influencing estimates differently.

Our study contributes to the literature that tries to understand response bias in self-reported opioid misuse. Surveys are the primary tool for estimating opioid misuse prevalence, yet under reporting and overreporting challenges have been documented.¹⁵ The magnitude of these measurement errors varies substantially depending on question design. A study of the 2006 United States' NSDUH directly compared open-ended questions with categorical questions for several drugs and found that

lifetime prevalence estimates based on open-ended questions were approximately 7 to 10 times lower than estimates from direct categorical questions.²² Also in the US, a 2009-2013 study of the national student survey showed that adding two brand-specific categorical questions increased non-medical opioid use prevalence by 3.3 percentage points.²³ Similarly, a 2013 study of the national Canadian survey showed that the prevalence of prescription opioid misuse increased from 2.0% when measured through a multi-part question to 7.7% when using a single wider question.⁷ Compared to these surveys, Encodat uses a middle ground seven-question design in which the open-ended validation questions try to help improve accuracy. Our study suggests that when using this middle-ground design, the open-ended questions are vital for the accuracy of opioid misuse estimates. To our knowledge, there are no other recent studies that have compared prevalence measurements of opioid misuse in national or other population surveys.

This study has several limitations. The open-ended questions were asked only to respondents who answered affirmatively to having used each substance (prescription opioids, heroin, or fentanyl). This precluded us from estimating validity measures such as sensitivity, specificity, positive predictive value and the negative predictive value, as these would have required the follow-up question to be asked to all respondents. Some studies use Cohen's kappa to assess agreement between two methods. However, this statistic assumes independence between measurements, and in our data, the open-ended question was nested within the categorical question, thereby violating the independence assumption. Although our study addressed response bias due to measurement tool characteristics, response bias due to social desirability or cognitive impairment may have more influence on misuse prevalence estimates. However, these sources of bias are largely outside investigators' control, unlike survey design, which is the focus of the present study.

The findings of this study have practical implications for epidemiological surveillance of opioid misuse. For the design of future Encodat in Mexico or other national household surveys, our results suggest that using a single categorical question to measure prescription opioids misuse would moderately overestimate the prevalence. A similar conclusion was reached after a 2006 analysis of the NSDUH, which led to an expansion of the questionnaire.²² The Inter-American Observatory on Drugs in 2021 proposed measuring prescription misuse through two categorical questions and a ten-answer flashcard.²⁴ This is a different approach to the one used in the 2025 Encodat, and could be considered, in which case comparing both measurements would be

critical. Countries with restricted resources that aim to measure prescription opioid misuse in their national surveys should consider their question selection carefully and/or account for a moderate overestimation if using a reduced set of questions of the prevalence when interpreting their results. On the other hand, measuring heroin and fentanyl use with single categorical questions would likely be sufficiently precise. This result suggests that the open-ended questions for illicit opioids could be trimmed if a questionnaire needed to be shortened for budgetary or other logistical reasons.

Conclusion

Our study suggests that general population surveys can reliably measure illicit opioid use through simple categorical questions, whereas prescription opioid misuse derived solely from categorical questions should be interpreted with caution, considering potential overestimation. Given the limited evidence available on how questionnaires influence opioid misuse measures in population surveys, our results contribute valuable methodological insights for epidemiological surveillance systems. Future research should aim to estimate validity, including sensitivity and specificity, to provide a better understanding of measurement accuracy in population-based opioid misuse. We hope this study will contribute to the improvement of survey-based monitoring of opioid misuse in Mexico and elsewhere.

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Declaration of conflict of interests. Magdalena Cerdá has received personal fees for providing expert input in opioid litigations. No other author declares competing interests.

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