

## REVIEW ARTICLE

## Chronic pain as a trigger for street opioid use: A systematic review

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## Abstract

The current opioid overdose crisis is significantly influenced by the evolving dynamics of drug markets, with fentanyl emerging as the predominant opioid in North America. Chronic pain remains a key driver of prescription opioid use among drug-using populations worldwide. This review examines the association between opioid misuse and chronic pain, particularly the transition from other prescribed analgesics to unprescribed fentanyl for pain management. We conducted a systematic review of literature from MEDLINE, CINAHL, Web of Science Core Collection, and PsycInfo using a combination of keywords, medical subject headings (MeSH), and Non-MeSH terms such as "fentanyl," "chronic pain," and "misuse." All papers that described unprescribed fentanyl use to treat pain were included. After screening, 16 studies remained, including case studies, qualitative studies, observational cross-sectional studies, and retrospective observational studies. Findings indicate that motivation for street fentanyl use often stemmed from a lack of sufficient pain management from prescribed medications. The stigma surrounding opioid prescriptions emerged as a major barrier; patients expressed shame when requesting higher doses of opioids, and providers were hesitant to prescribe them. One limitation of this review is the small number of included studies and the heterogeneity of study designs, which may limit generalizability. Overall, our review found that un- or undertreated chronic pain is a critical reason fueling the shift toward fentanyl use in the current overdose crisis. Improvements in access to qualified pain treatment and targeted training for clinicians in opioid stewardship and pain monitoring may help reduce the number of street opioid users.

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## 1. Introduction

The dynamic, ever-changing nature of drug markets continues to play a large role in the ongoing North American overdose crisis. The number of recent opioid-related overdose fatalities is driven by the prevalence of fentanyl and fentanyl analogs in the supply.<sup>1</sup> Fentanyl is a highly potent, synthetic analgesic that acts at the  $\mu$ -opiate receptor and is often used for the clinical management of pain. Currently, fentanyl dominates the drug markets in North America due to its high potency, increased availability, underestimated risks, and low costs.<sup>2</sup> Estimated to be 50 – 100 times more potent than morphine and

significantly cheaper than heroin,<sup>3,4</sup> fentanyl use has shifted from sporadic contamination to intentional consumption. This shift, accompanied by local productions and increased purity, has made fentanyl the main drug of choice among many street opioid users today.<sup>4-6</sup>

Concurrent with the growing rates of opioid dependence, the prevalence of pain continues to be a significant health problem, with high prescription rates of opioids associated with increased opioid treatment admissions and overdose mortalities.<sup>7</sup> This high prominence of pain and pain-related diseases is the leading cause of disease burden globally.<sup>8</sup> Pain has many effects on individuals, greatly impeding quality of life as well as the mental and physical aspects of daily living.<sup>9</sup> This is particularly the case for chronic pain, which is defined as pain that lasts for over three consecutive months.<sup>10</sup> While opioids are often used to treat pain, prescribing patterns have faced controversy in recent years. The effectiveness of opioids in treating acute pain is well supported in the literature.<sup>11</sup> However, with the heightened prescription of opioids for pain, particularly for chronic cases, the risk for adverse events, such as overdose, physiological dependence, withdrawal, and addiction, increases.<sup>12,13</sup> Consequently, some experts believe that the widespread nature of pain and easy accessibility of potent opioid analgesics encourage a shift from prescription opioid use to nonmedical use of these substances.<sup>14</sup> While a body of evidence supports this association for other opiates, such as oxycodone, it remains unclear whether pain and inadequate treatment, including insufficient opioid stewardship, have driven users toward intentional fentanyl use. Despite the central role of unprescribed fentanyl in the current overdose crisis, there remains a significant gap in our understanding of its rapid growth, including how it may be misused within the field of pain management, the motivations behind choosing fentanyl, and its concurrent use with other medications for pain. Unprescribed fentanyl differs significantly from medically regulated fentanyl, carrying numerous risks, impurities, and analogs, as well as an increased propensity for overdose, all of which contribute to its unpredictability. The purpose of this study was to investigate the association of unprescribed fentanyl use with pain, exploring whether the rise of fentanyl and fentanyl analogs may be linked to undertreated pain. This review aims to provide insights into the specific misuse of fentanyl as the preferred opioid for pain management, given its prominence in recent overdose deaths. Fentanyl is prioritized over other opioids due to its distinct role in pain treatment, domestic production, and unique risk profile. As a synthetic, low-cost, and highly accessible substance that has taken over heroin as the predominant street opioid, it is hypothesized that patients with unmanaged pain may be driven to seek unprescribed

fentanyl as a form of cost-effective self-medication in lieu of other adequate interventions.

## 2. Methods

### 2.1. Search strategy and inclusion/exclusion criteria

The databases MEDLINE, CINAHL, Web of Science Core Collection, and PsycInfo were searched for published articles in English. A combination of validated search filters and database-specific filters was used with search terms and Boolean operators (AND/OR) to retrieve relevant literature on chronic pain and non-medical fentanyl use. A medical librarian was consulted regarding search strategies. For the inclusion criteria, all studies that reported on chronic pain and non-medical fentanyl use were included. For the exclusion criteria, articles on the topics of animal pain, other opioids other than fentanyl and fentanyl analogs, and clinical fentanyl use were excluded.

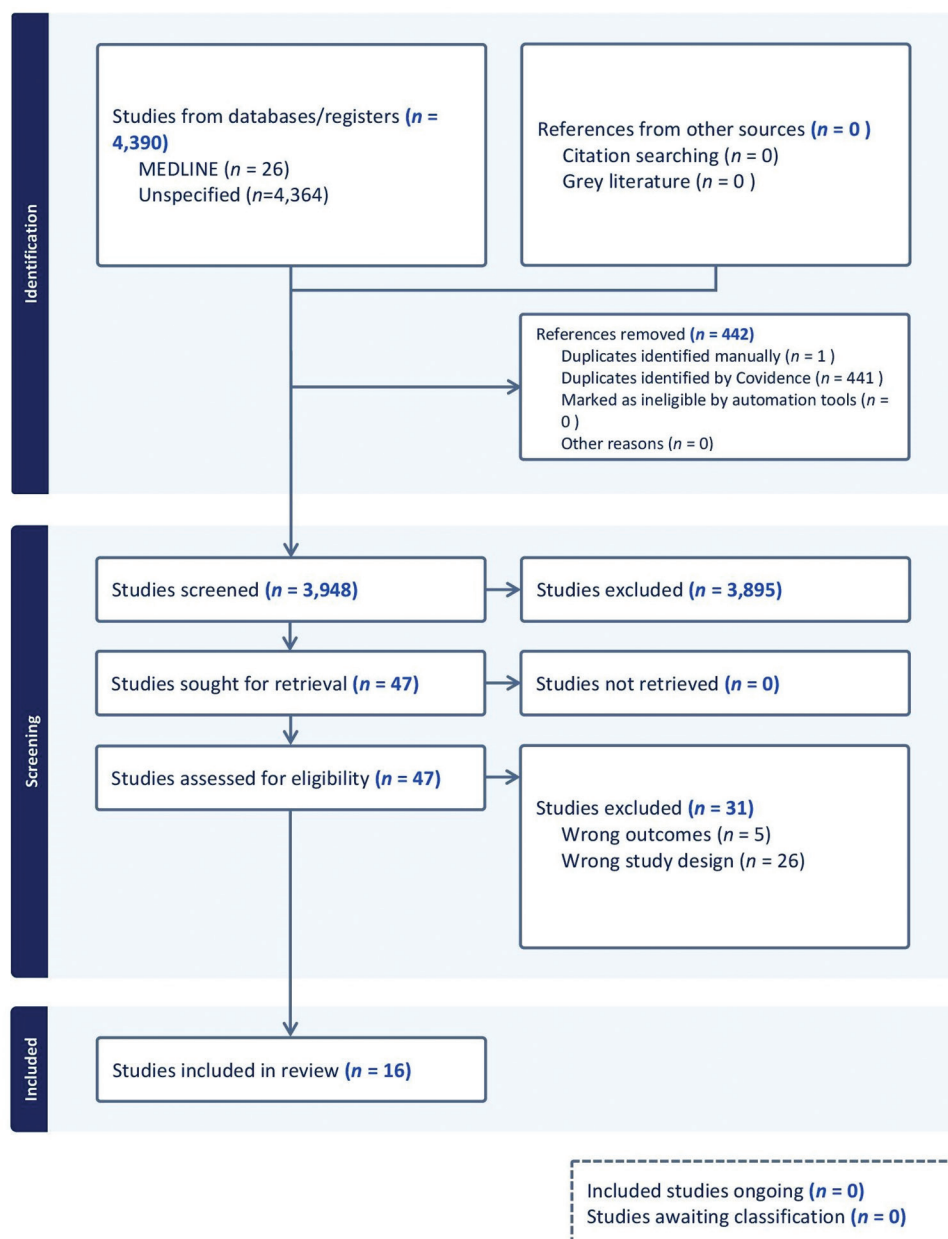
### 2.2. Search terms

To find articles on the co-occurring nature of pain and illicit fentanyl use as a form of self-medication, a combination of the following keywords and medical subject headings related to fentanyl misuse and pain were used to retrieve articles from each database. The detailed search string used was fentanyl use (e.g. chronic fentanyl use OR fentanyl use OR fentanyl OR carfentanil OR carfentanil use OR fentanyl abuse OR fentanyl addiction OR fentanyl illicit use OR fentanyl misuse OR) and chronic pain-related terms (e.g. self-medication OR chronic pain OR co-occurring pain OR pain analgesia OR recreational use OR pain OR persistent pain OR long-term pain OR pain management OR non-prescription). A backward search of the references of published articles was also performed to avoid missing any relevant studies. All study types were included except for abstracts, editorials, and conference proceedings.

### 2.3. Screening and data extraction

The preferred reporting items for systematic reviews and Meta-analyses method and guidelines were used to select eligible papers.<sup>15</sup> Two authors (DH, JK) independently reviewed filtered articles using the title and abstract through Covidence. This was performed using the predetermined inclusion and exclusion criteria. Subsequently, a full-text review was conducted on the resulting studies. All discrepancies were resolved through discussion with all authors. A total of 16 studies were included in the review (Figure 1). The Joanna Briggs Institute validated quality assessment tools were used to assess the quality of included studies (Table S1).

Following full-text screening, data from the selected studies were extracted and charted using Microsoft



**Figure 1.** The preferred reporting items for systematic reviews and meta-analyses flow diagram for study selection

Excel (version 16.98). Data were organized into specific categories relevant to the publication (e.g., title, author, publication year, journal), methods (e.g., type of study, timeline, country), and population (e.g., age, gender, sample size). Pain-related data (e.g., location of pain, the severity of pain, and past pain treatment) and fentanyl-related data (e.g., self-medication, fentanyl dosage, route of administration, source of diverted fentanyl) were independently collected using a table. Both qualitative and quantitative data were collected to account for the differences in study instruments, settings, and types of

studies included (Table S2). The charted data were further categorized by the reasons for using unprescribed fentanyl as distinct themes (e.g., ineffective pain management, stigma, or recreational high).

### 3. Results

A total of 16 studies were included from five countries, with the most studies conducted in Canada ( $n = 5$ ), followed by the United States of America ( $n = 4$ ), Australia ( $n = 2$ ), Greece ( $n = 1$ ), and Turkey ( $n = 1$ ). Three studies did not specify their location ( $n = 3$ ). The studies' publication

years ranged from 2007 to 2024. Among these, seven papers were case studies, four were qualitative studies, three were observational cross-sectional studies, and two were observational retrospective studies. Most studies reported self-medication using fentanyl ( $n = 16$ ). In studies reporting the demographic information of users, most were predominantly identified as male and ranged from ages 20 to 70 years. A limited number of studies noted the racial backgrounds of users, but subgroups of Indigenous individuals were identified in two separate studies. Most sources of unprescribed fentanyl were illicit ( $n = 10$ ), followed by diversion from doctors or hospitals ( $n = 9$ ), diversion from family and friends ( $n = 6$ ), safe supply ( $n = 1$ ), and stockpiling their own prescription ( $n = 1$ ). For the route of administration, 10 studies discussed transdermal fentanyl patch use, eight discussed intravenous injection, six discussed oral consumption, and three discussed nasal inhalation. Dosages of fentanyl abuse ranged from 0.0066  $\mu\text{g/mL}$  to 400  $\mu\text{g/mL}$ . Locations of identified pain varied, with most ( $n = 6$ ) studies reporting localized pain in the back.

The severity of pain was found to range from being moderate to severe, in one case reaching an intensity of 8 on a numerical scale out of 10.<sup>16</sup> Areas of localized pain included the back,<sup>17-22</sup> legs and/or feet,<sup>17,18,22,23</sup> arms and/or hands,<sup>17,18</sup> ribs,<sup>18</sup> and abdomen.<sup>22,24</sup> Many forms of past treatments of pain were used, including morphine,<sup>18,19,24,25</sup> hydromorphone,<sup>25</sup> oxycontin/oxycodeone,<sup>16,18,21,25</sup> buprenorphine,<sup>17,18,25</sup> and codeine.<sup>16,25</sup> However, other medications for prior pain treatment were observed, such as diazepam (Valium), hydrocodone (Lorcet), oxycodone/acetaminophen (Percocet), hydrocodone (Vicodin),<sup>20</sup> and propoxyphene (Darvon).<sup>26</sup>

Self-medication using fentanyl was consistently reported among individuals suffering from chronic pain. Sources for misused fentanyl encompassed diversion from the doctor,<sup>17,18,25,26</sup> misusing prescriptions (e.g., increasing

the frequency or changing routes of administration),<sup>21,26</sup> using a friend or relative's medication,<sup>18,21,27-29</sup> safe supply,<sup>25</sup> and illicit sources.<sup>17,18,22,24,25,27,28</sup> Similarly, large variability was found for routes of administration of fentanyl. These included intravenous/injection (e.g., of fentanyl sourced from transdermal patches),<sup>17,18,22,24,27,28,30,31</sup> transdermal,<sup>16,19,21,23,26,29,30</sup> nasal,<sup>18</sup> and oral.<sup>18,20,21,26,29</sup> Other substances commonly used for self-medication of pain, either taken in combination with fentanyl or alone, were oxycontin/oxycodeone,<sup>18,27,30</sup> morphine,<sup>25,27,30</sup> hydromorphone,<sup>17</sup> cocaine,<sup>25</sup> methamphetamine,<sup>24</sup> and heroin.<sup>27</sup>

Several reasons for using unprescribed fentanyl were associated with the complex relationship of pain and self-medication (Table 1). Two papers highlighted rapid tapers or sudden discontinuation of opioids as a source of continued pain,<sup>18,25</sup> leading patients who depended on opioids to seek alternative sources. Six papers described ineffective pain management as a key driver for fentanyl use.<sup>16,20,21,24,27</sup> Stigma was a highly relevant topic among most papers, being a key component in individuals choosing to misuse fentanyl for pain relief rather than seeking help through the healthcare system. Specifically, negative experiences with the healthcare system,<sup>17,20,22,27,29</sup> including feeling dismissed, concerns not taken seriously, and denial of adequate pain medication due to a history of opioid dependence,<sup>17,18,27</sup> were described as motivations for turning to unprescribed fentanyl.

The experience of a recreational high was accounted as an additional reason for using accessible fentanyl.<sup>18,19,28</sup> Only two studies mentioned the use of psychotherapy as a complementary approach to managing pain, highlighting a significant gap.<sup>20,26</sup> Similarly, six studies explicitly discussed structured pain management,<sup>16,18,20,26,29</sup> with only two studies mentioning access to a trained "pain specialist."<sup>18,20</sup>

**Table 1. List of final included studies according to motivations for fentanyl misuse**

Motivations for fentanyl misuse	No. of studies	Typical pain context	Routes of administration	Notable co-substances	Studies
Ineffective pain management	11	Moderate to severe pain, chronic pain, and arthritic pain	Transdermal, nasal, oral, intravenous, and oral abuse of transdermal patches	Benzodiazepines, morphine, oxycodone, alcohol, opium gum, 4-methylenedioxymethamphetamine, methadone, codeine, and alprazolam	16,20-24,26,27,29-31
Stigma	5	Serious accident or illness, chronic pain, and withdrawal pain	Intravenous, oral, and sniffing	Cocaine, cannabis, diverted Dilaudid, Lorcet, Vicodin, suboxone, oxycontin, methadone, morphine, and buprenorphine	17,18,20,22,27
Recreational high	3	Fibromyalgia, severe chronic, Crohn's disease, impaired mobility, chronic obstructive pulmonary disease, and unspecified heart disease	Transdermal and intravenous	Morphine, Percocet, Dilaudid, hydromorphone, heroin, and buprenorphine	19,25,28



Some papers mentioned the higher availability and lower cost of fentanyl to incentivize its misuse for pain management.<sup>18,25</sup> The costs of fentanyl were affordable, with prices varying from 2 to 10 Canadian dollar. One individual study described fentanyl as a cost-effective opioid to alleviate pain.<sup>25</sup>

## 4. Discussion

This systematic review examined the relationship between pain management and the emergence of illicit fentanyl and its analogs as dominant agents in the current opioid crisis. The evidence consistently highlights a strong association between inadequate pain management, poor opioid stewardship, and the escalation of fentanyl misuse. Individuals with unmanaged or under-treated pain—particularly those with a history of substance use disorder—are disproportionately driven to seek relief through illicit sources. Contributing factors include stigma, patient unawareness of associated risks, inconsistent prescribing practices, abrupt dose reductions, and the financial burden of prescription opioids. Notably, patients with current or past substance use disorder frequently experienced restricted access to adequate pain treatment, often being denied appropriate prescriptions or dosages to effectively manage their pain. While some individuals reported using fentanyl for its euphoric effects, the primary motivator across studies remained the persistent and unresolved experience of pain.

Importantly, the review identified a significant lack of integration of non-opioid and interdisciplinary pain management strategies, such as psychotherapy or structured care involving pain specialists. This gap, coupled with barriers to accessing safe and consistent treatment, suggests a need for comprehensive reform in pain care delivery. Clinical practice must evolve to recognize the legitimate pain experiences of patients with or at risk for substance use disorder and ensure equitable, non-stigmatizing access to evidence-based pain management.

Several studies reported individuals using fentanyl in combination with other lower-potency opioids, such as oxycodone or morphine, which are commonly prescribed for acute pain. Another common substance co-used with fentanyl included benzodiazepines, which have been previously highlighted for their non-prescribed use to self-medicate psychological pain, such as anxiety or mania. Qualitative studies have also found users seeking out benzodiazepines for the purpose of enhancing opioid intoxication. Fentanyl's short duration of action on its own describes how substances may be intentionally selected and popularized in the market to extend the duration of pain relief in users. In the medical setting, factors behind

the insufficient treatment of pain in patients with opioid use disorder often include providers' misconceptions about maintenance opioid agonists providing analgesia and the fear of addiction relapse.<sup>32</sup> As a result, providers are often reluctant to prescribe stronger opioids due to fears of diversion, leading to underdosing or abrupt tapering. The stigma around opioid use disorder is a significant barrier to effective pain management, which exists both within the individual and the healthcare system. Reluctance to seek treatment for pain management was often fueled by the patient's belief in surviving without or with minimal intervention. It was also common for patients to feel ashamed in requesting higher doses of pain medication from their physicians for fear of being labeled as a "junkie" or "drug addict" or in anticipation of being denied. As our results suggest, this can, unfortunately, push individuals who are not finding adequate pain relief through the healthcare system to seek unprescribed or diverted sources of opioids.

Moreover, another challenge faced is the deterioration of pain control with prolonged use of an analgesic method. We observed that this is particularly the case with transdermal fentanyl patches, which underwent many methods of misuse, such as changing them frequently, inhaling the smoke of heated patches, injecting extracted fentanyl, as well as chewing or swallowing.<sup>31</sup> Despite the initial effectiveness of a method in pain relief, it is important to consider how patient satisfaction with pain treatment rarely stays stagnant over time. While many patients included in our study had initial access to pain management, they often described that prescriptions could not help them thoroughly deal with pain on a long-term basis, which led them to misuse the medication. It is expected that this is especially the case when individuals are left unmanaged by or detached from the system of care, especially the homeless and other stigmatized populations, as the fear and consistency of pain can easily motivate an individual to change to riskier patterns of use. Another important consideration is the influence of mental distress on the physical sensation of pain. Studies have found that mental illness can exacerbate the perception of experienced pain. However, in our studies, we only found two studies that provided patients with any form of psychotherapy to complement their pain management.

Usage of fentanyl and its analogs significantly increases the potential toxicity and risk of overdose, contributing to the ongoing opioid overdose crisis. We observed a large proportion of literature analyzing post-mortem cases in relation to overdose deaths using unprescribed fentanyl or diverted sources for pain relief that were not sufficiently treated using medical means. Similarly, fentanyl was

detected in 83% of the total 2,271 reported drug toxicity deaths in British Columbia in 2024.<sup>33</sup> This is an ongoing concern as the potency and possible adulterants within fentanyl purchased on the street decrease the ability of individuals to practice risk management. Although some studies report that individuals acknowledge using fentanyl for its euphoric or psychoactive effects, this motivation is often secondary to pain relief. The evidence from this review indicates that systemic barriers—including stigmatizing care practices, inadequate pain treatment infrastructure, and restrictive opioid policies—more accurately explain why individuals turn to fentanyl for unmanaged pain. These findings challenge narratives of personal irresponsibility and instead call for structural reforms that prioritize equitable, patient-centered pain treatment and care.

One area of enactment is to develop better policies around addiction treatment within inpatient settings amidst pain care. The use of online technologies to establish a dedicated chronic pain service may provide the means to stay vigilant to patient needs and engagement.<sup>10,34</sup> Beneficial changes to the current guidelines include standardizing opioid prescriptions, making addiction treatment accessible, and aligning treatments for pain and opioid use.<sup>22</sup> In addition, there is limited access to qualified pain treatment as training in pain management is reported as minimal.<sup>35</sup>

Addressing the intersection of chronic pain and fentanyl misuse requires policy interventions that recognize the overlapping clinical needs of individuals with pain and opioid use disorders. Central to this effort is the development of integrated care models that combine comprehensive pain management with addiction treatment, guided by standardized clinical protocols. Opioid prescribing policies should be reformed to avoid rapid or abrupt tapering, which can lead to uncontrolled pain and increased risk of nonmedical opioid use. Access to multidisciplinary pain services should be expanded, including increased training of pain and addiction medicine specialists. Provider education initiatives are also needed to reduce stigma and improve clinical responsiveness to patients with complex care needs. In parallel, withdrawal management services, opioid agonist therapies, substitution programs, and prevention programs should be scaled up and more closely linked with pain management pathways. Further research is essential to evaluate the effectiveness of integrated treatment models and identify systemic barriers that influence transitions between medical and non-medical opioid use.

Our review has several strengths that enhance its value in the developing literature on fentanyl, including the use of

numerous multidisciplinary databases and the evaluation of both quantitative and qualitative outcomes. This has resulted in an increase in the overall breadth of our search and ensured that all papers covering pain and unregulated fentanyl use were adequately found and covered. Given the rise of fentanyl use in North America and worldwide, this topic is of critical concern in the upcoming years.

As observed in the current opioid crisis, our review confirmed that the limited options for pain can cause individuals to seek fentanyl from the unregulated drug market. Without the proper opioid stewardship and regulations, especially for high-potency opioids such as fentanyl, there still exists a risk that the waves of the opioid crisis will continue and more lives will be lost.

This review highlights the urgent need for further governmental and communal investment in substance use disorder care, specifically for the concurrent management of opioid use and pain.

## 5. Limitations

The limitations of this review stem from the small number of papers focused solely on fentanyl ( $n = 16$ ), which limits generalizability. Many of the papers found were based in overlapping regions within North America and may not be generalizable to other regions where fentanyl is not as dominant in the drug supply. In addition, the numerous case studies included increasing the heterogeneity of our findings as they are written on a case-by-case basis. Furthermore, no specific demographic or environmental factors associated with unprescribed fentanyl were identified in this review, which highlights both the ubiquity of fentanyl in the unregulated markets and the global impact of pain affecting all individuals. Further work could be done to explore specific subpopulations that are more prone to experiencing chronic pain—such as those who are older or identify as belonging to a minority group—and quantify their relative risk of seeking out unprescribed fentanyl. Generally, despite the wide prevalence of overdose deaths involving fentanyl, there still exists a lack of information on individuals suffering from pain and seeking unregulated fentanyl, which is reflected by the minimal information on the specific dosing, other co-used substances, and route of administration. Finally, due to the widespread nature of fentanyl and fentanyl analogs distributed in the unregulated supply, there was a lack of concrete certainty whether individuals purposely sought fentanyl or fentanyl was mixed with other unprescribed opioids, resulting in our conclusions being largely based on narrative synthesis.

Despite these limitations, our review also comes with several strengths that enhance its value in the developing

literature on fentanyl, including the use of numerous multidisciplinary databases and evaluation of both quantitative and qualitative outcomes. This has expanded the overall scope of our search and ensured comprehensive coverage of studies addressing pain and unregulated fentanyl use. As fentanyl continues to proliferate across North America and globally, this issue remains a key concern for the years ahead.

## 6. Conclusion

Our findings indicate that many individuals find current treatment modalities for pain management to be inaccessible or inadequate for addressing the high level of pain experienced. This and poor experiences within the healthcare system are strong motivators for individuals to turn to unprescribed fentanyl for pain relief, greatly increasing overdose risk. Ultimately, addressing the overlapping crises of untreated pain and fentanyl-related harms will require a shift from fragmented, risk-averse practices to comprehensive, patient-centered systems of care. Ongoing research, policy reform, and investment in integrated service delivery are essential to prevent further marginalization of individuals whose pain—and whose needs—are too often left unmet by the current healthcare system.

Given the predominance of qualitative evidence and the limited availability of quantitative data in this field, future research should prioritize more rigorous studies to better understand the relationship between chronic pain and unprescribed fentanyl use. Future work should identify safe and effective pain treatment procedures, especially for highly vulnerable and multimorbid clients, as well as adapt treatment protocols to reflect evolving patterns of drug use.

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## Conflict of interest

The authors declare they have no competing interests.

## Author contributions

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*Writing – original draft:* Dianah Hayati, Jane Kim

*Writing – review & editing:* All authors

## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of data

Not applicable.

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