

Opioid Addiction Among Veterans: A Silent Crisis

Benjamin Adejumo *

Western Covenant University, Los Angeles, CA, United States.

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Abstract

This study examines the multidimensional determinants of opioid addiction among U.S. military veterans using a cross-sectional survey of 387 veterans receiving care within Veterans Health Administration-affiliated facilities. Guided by self-medication, stress-diathesis, and social learning perspectives, the study integrates clinical, psychosocial, and treatment-related factors into a unified empirical framework. Multiple linear regression and multivariate logistic regression models are used to assess predictors of opioid addiction severity and high addiction risk. Results indicate that long-term opioid therapy, alcohol and stimulant comorbidity, loneliness, and housing instability significantly increase addiction severity and the likelihood of high-risk classification, while treatment engagement exerts a strong protective effect. The models demonstrate strong explanatory power and satisfactory diagnostic performance. Findings highlight the combined role of polysubstance use and social vulnerability alongside clinical exposure in shaping opioid outcomes. The study contributes theory-informed evidence by modelling both continuous and binary addiction outcomes. Policy implications emphasise integrated care combining pain management, substance use treatment, housing stabilisation, and social support to effectively address opioid addiction among veterans.

Keywords: Opioid Addiction; Self-Medication; Stress-Diathesis; Veterans

1. Introduction

The opioid crisis remains one of the most persistent public health emergencies in the United States, with military veterans experiencing a disproportionately high burden of opioid exposure, misuse, and overdose mortality. Veterans' elevated risk reflects the intersection of chronic pain, combat-related injuries, post-traumatic stress disorder (PTSD), mental health comorbidities, and long-term exposure to prescribed opioids within clinical care pathways. Large-scale evidence from the Veterans Health Administration (VHA) shows substantial opioid-involved overdose mortality among veterans over the past decade, with mortality trends remaining alarming despite policy and prescribing reforms (Begley et al., 2022; Peltzman et al., 2020). National-level analyses further demonstrate that co-prescription of opioids and benzodiazepines is associated with elevated mortality risks among veterans, underscoring the clinical complexity of pharmacological management in this population (National Academies of Sciences, Engineering, and Medicine [NASEM], 2025). Systematic reviews and population-based studies also indicate that prescription opioid misuse and overdose among veterans are closely linked to broader substance use patterns, including alcohol and stimulant involvement, compounding morbidity and mortality risks (Tam et al., 2020; Lin et al., 2022; Coughlin et al., 2022). Collectively, this evidence situates opioid addiction among veterans as a multidimensional crisis embedded within clinical, psychological, and social determinants of health.

A defining challenge in the veteran opioid crisis is the widespread use of long-term opioid therapy (LTOT) for chronic pain and its evolving trajectories over time. Recent longitudinal analyses reveal heterogeneous LTOT pathways among veterans, with elevated risks among those with comorbid substance use disorders (Axson et al., 2024). Empirical evidence further shows that veterans receiving LTOT are more likely to exhibit unhealthy alcohol use and reduced

* Corresponding author: Benjamin Adejumo; ORCID: 0009-0009-8252-656X.

engagement with alcohol-related care, highlighting gaps in integrated substance use management (Joudrey et al., 2024; Lin et al., 2022). Studies also document high prevalence of substance use disorders among veterans on LTOT, reinforcing concerns about iatrogenic risk within pain management systems (Ngo et al., 2025). In response, the VHA has implemented opioid prescribing and risk mitigation strategies, including monitoring programs and clinical guidelines; however, implementation variability and real-world effectiveness remain uneven (Sandbrink et al., 2020). These challenges are further exacerbated by social vulnerabilities such as homelessness and social isolation, which are strongly associated with opioid use disorder and non-prescribed opioid use among veterans (Manhapra et al., 2021; McDonagh et al., 2020). Together, these dynamics illustrate that opioid addiction among veterans is not solely a prescribing problem but a complex systems issue shaped by clinical practice, social conditions, and comorbid behavioural health needs.

Conceptually, opioid addiction among veterans can be situated within three interrelated theoretical frameworks: the Self-Medication Hypothesis, Stress–Diathesis Theory, and Social Learning Theory. The Self-Medication Hypothesis posits that individuals use psychoactive substances to cope with psychological distress, trauma, and affective dysregulation, mechanisms highly salient in veteran populations with PTSD and chronic pain (Khantzian, 1997). Stress–Diathesis Theory emphasises how pre-existing vulnerabilities interact with environmental stressors, such as combat exposure, injury, and reintegration stress, to precipitate substance use disorders (Monroe & Simons, 1991). Social Learning Theory highlights the role of social contexts, norms, and modelled behaviours in shaping substance use trajectories (Bandura, 1977). While all three frameworks are relevant, this study is primarily underpinned by the Self-Medication Hypothesis because of its strong explanatory power in linking trauma, pain, psychiatric comorbidity, and opioid misuse among veterans. Qualitative and mixed-methods research demonstrates how stigma, PTSD, and identity-related stressors shape veterans' coping strategies, including substance use, reinforcing the relevance of self-medication processes (Elliott et al., 2018; Bennett et al., 2022). This theoretical grounding provides a coherent lens for understanding why opioid addiction persists among veterans despite clinical reforms and prevention efforts.

Empirically, prior studies have advanced understanding of risk factors, prevention strategies, and treatment utilisation among veterans, including reviews of overdose risk, peer specialist interventions, and community-based suicide and substance use prevention efforts (Bennett et al., 2022; Monteith et al., 2020; Ranney et al., 2024). Research has also examined treatment access and policy approaches to expanding medications for opioid use disorder (MOUD), highlighting both progress and persistent gaps within and outside the VHA system (Priest et al., 2020). However, much of the existing literature remains fragmented, often focusing on isolated outcomes such as mortality, specific substances, or discrete interventions without integrating long-term therapy trajectories, polysubstance use, social vulnerabilities, and system-level care pathways into a unified analytical framework (Axson et al., 2024; Coughlin et al., 2022; Manhapra et al., 2021). This study addresses this gap by providing a comprehensive, theory-informed synthesis that integrates LTOT dynamics, comorbid substance use, social risk factors, and evolving care strategies to conceptualise opioid addiction among veterans as a silent, system-embedded crisis. The novelty of this study lies in its integrative approach, which moves beyond single-outcome analyses to examine how clinical, psychological, and social mechanisms jointly shape opioid addiction trajectories among veterans. Guided by this objective, the study addresses the following research questions: (1) What are the major clinical and social determinants associated with opioid addiction among U.S. veterans? (2) How do long-term opioid therapy and comorbid substance use shape addiction and overdose risk trajectories? and (3) To what extent do current prevention and treatment strategies adequately address the multidimensional nature of opioid addiction among veterans?

2. Literature Review

Theoretical perspectives provide a critical foundation for understanding opioid addiction among veterans, particularly in explaining how trauma exposure, chronic pain, psychosocial stressors, and social environments interact to shape substance use trajectories. The Self-Medication Hypothesis is strongly reflected in veteran-focused research, which consistently demonstrates that veterans use opioids and other substances to cope with psychological distress, PTSD, and pain-related impairment. Bennett et al. (2022) synthesise evidence showing that PTSD, depression, and chronic pain are central drivers of opioid misuse and overdose risk among U.S. military veterans, aligning closely with self-medication mechanisms. Elliott et al. (2018) further highlights how veterans negotiate PTSD-related stigma and identity stress, shaping maladaptive coping strategies that may include substance use. These findings reinforce the relevance of self-medication processes in explaining why opioid use persists even within regulated clinical environments. Stress–Diathesis Theory is also supported by evidence that veterans' pre-existing vulnerabilities, when combined with environmental stressors such as homelessness, reintegration challenges, and comorbid mental illness, significantly increase the likelihood of opioid use disorder. Manhapra et al. (2021) demonstrate a strong national association between opioid use disorder and homelessness among veterans in the VHA, underscoring how structural and social stressors activate latent vulnerabilities. Social Learning Theory is reflected in studies showing how peer contexts,

community environments, and modelled behaviours influence substance use and recovery pathways. Ranney et al. (2024) show that peer specialist-led interventions within the VHA play an important role in shaping care engagement and recovery behaviours, highlighting how social modelling and support structures influence opioid-related outcomes. Collectively, these studies empirically ground the three theoretical perspectives within veteran populations and justify their relevance to understanding opioid addiction as a multidimensional behavioural and social process.

Empirical research has extensively examined opioid prescribing patterns, overdose mortality, and risk mitigation strategies among veterans. Peltzman et al. (2020) investigated opioid-involved overdose mortality among U.S. veterans using national surveillance data and found persistently high mortality rates, concluding that overdose remains a major public health threat despite policy reforms. Begley et al. (2022) extended this work by analysing veteran drug overdose mortality from 2010 to 2019, using population-level mortality data, and reported rising overdose deaths involving opioids and polysubstance use, recommending strengthened surveillance and targeted prevention strategies. The National Academies of Sciences, Engineering, and Medicine (2025) employed three target trial emulations to examine the relationship between prescription opioids, benzodiazepines, and mortality among veterans from 2007 to 2019, concluding that co-prescribing substantially elevates mortality risk and recommending tighter prescribing and monitoring policies. These studies collectively establish overdose mortality as a persistent and evolving crisis among veterans.

Long-term opioid therapy (LTOT) has emerged as a central focus in the literature due to its role in shaping addiction and overdose risk. Axson et al. (2024) analysed long-term opioid therapy trajectories among veterans with and without substance use disorders using longitudinal VHA data and found heterogeneous patterns, with veterans with comorbid substance use disorders exhibiting higher risk and more unstable opioid trajectories. Ngo et al. (2025) examined substance use and use disorders among veterans on LTOT using observational data and reported a high prevalence of co-occurring substance use disorders, concluding that LTOT populations require enhanced screening and integrated treatment approaches. Joudrey et al. (2024) focused on alcohol-related care among veterans with unhealthy alcohol use and assessed the role of LTOT receipt, finding that LTOT was associated with differences in alcohol care engagement, highlighting gaps in integrated management of polysubstance use. Lin et al. (2022) examined alcohol-involved overdose deaths among U.S. veterans and reported significant overlap between alcohol and opioid involvement, recommending coordinated substance use treatment strategies. Together, these studies demonstrate that LTOT is a critical clinical pathway through which addiction risk is amplified and complicated by comorbid substance use.

Polysubstance use and stimulant involvement further complicate opioid addiction among veterans. Coughlin et al. (2022) investigated patient characteristics and treatment utilisation in fatal stimulant-involved overdoses in the VHA and found that stimulant use frequently co-occurred with opioid use, with significant gaps in treatment utilisation before death. Their findings emphasise the importance of addressing co-occurring substance use in veteran populations. Tam et al. (2020), in a systematic literature review, examined prescription opioid misuse and its correlates among veterans and military personnel and identified strong associations with mental health disorders, alcohol use, and other substance use, concluding that comprehensive, integrated care models are necessary. These findings reinforce the multidimensional nature of opioid addiction and the limitations of single-substance or siloed treatment approaches.

Social vulnerability and psychosocial factors are also consistently identified as key determinants of opioid addiction among veterans. Manhapra et al. (2021) showed that homelessness is strongly associated with opioid use disorder within the VHA, concluding that housing instability represents a major structural risk factor. McDonagh et al. (2020) examined loneliness and non-prescribed opioid use among patients with opioid use disorder and found that loneliness was significantly associated with illicit opioid use, recommending the incorporation of social support interventions into addiction treatment. Elliott et al. (2018) further documented how stigma and identity negotiation among post-9/11 veterans shape help-seeking and substance use behaviours, highlighting the social and cultural dimensions of addiction. These studies collectively underscore that opioid addiction among veterans is deeply embedded in social isolation, housing insecurity, and identity-related stress.

Policy and system-level interventions have also been widely studied. Sandbrink et al. (2020) examined opioid prescribing and risk mitigation strategies in the VHA and documented the implementation of monitoring programs, guideline-based prescribing, and clinical decision supports, concluding that while these strategies have improved oversight, significant variation remains in practice. Priest et al. (2020) explored program and policy approaches to expanding access to medications for opioid use disorder outside the VHA, highlighting transferable lessons for improving access and continuity of care, and recommending broader adoption of flexible treatment delivery models. Monteith et al. (2020) evaluated community-based suicide prevention strategies for rural veterans and emphasised alignment with national VHA strategies, concluding that community-engaged models are critical for addressing co-occurring suicide and substance use risks. Ranney et al. (2024) reviewed peer specialist-led interventions in primary

care within the VHA and found evidence of improved engagement and support, recommending broader integration of peer support in addiction and mental health services. These studies highlight the importance of multi-level, system-wide strategies in addressing opioid addiction among veterans.

Despite this extensive body of research, the literature remains fragmented, with most studies focusing on isolated dimensions such as mortality, prescribing practices, LTOT, homelessness, or specific interventions. Few studies integrate long-term opioid therapy trajectories, polysubstance use, psychosocial vulnerability, and system-level care strategies within a unified, theory-informed framework. Moreover, much of the literature emphasises outcomes rather than mechanisms, limiting understanding of how clinical, psychological, and social processes interact over time to sustain opioid addiction among veterans. This study contributes to the literature by providing an integrative, theory-guided synthesis that conceptualises opioid addiction among veterans as a silent, multidimensional crisis shaped by self-medication processes, stress-vulnerability interactions, and socially learned behaviours within complex care systems. By linking LTOT dynamics, comorbid substance use, social risk factors, and institutional responses, this study advances a more comprehensive understanding of opioid addiction among veterans and offers a stronger empirical and conceptual foundation for future policy and clinical interventions.

3. Research Methodology

This study adopts a quantitative, cross-sectional survey research design to examine the clinical, psychosocial, and system-level determinants of opioid addiction among U.S. military veterans. The design is appropriate for capturing patterns of long-term opioid therapy exposure, comorbid substance use, social vulnerability, and treatment engagement at a single point in time, while enabling statistical testing of associations across multiple risk domains. A cross-sectional approach has been widely used in veteran opioid research to analyse prescribing patterns, overdose risk, and comorbidities within the Veterans Health Administration (VHA) and related veteran populations (Axson et al., 2024; Ngo et al., 2025; Manhapra et al., 2021). This design supports theory-informed empirical testing aligned with the self-medication, stress–diathesis, and social learning perspectives by allowing simultaneous measurement of trauma-related symptoms, long-term opioid therapy exposure, social vulnerability, and engagement with prevention and treatment services.

3.1. Population of the Study

The population of the study comprises registered U.S. military veterans receiving care for chronic pain, substance use disorders, or behavioural health conditions at selected Veterans Health Administration medical centres and affiliated veteran outpatient clinics. Based on administrative records obtained from participating facilities, the total accessible population for this study is 12,450 veterans, representing veterans enrolled in pain management, primary care, mental health, and substance use treatment programs across the selected centres during the study period. This finite population reflects veterans with documented exposure to prescription opioids, behavioural health screening, or substance use services, consistent with prior veteran-focused opioid studies conducted within the VHA system (Axson et al., 2024; Sandbrink et al., 2020; Begley et al., 2022).

3.2. Sample Size Determination and Sampling Technique

The sample size for this study was determined using Yamane's (1967) finite population sample size formula, which is appropriate when the population size is known:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = sample size

N = population size (12,450)

e = level of precision (0.05)

$$n = \frac{12,450}{1 + 12,450 (0.05)^2}$$

$$n = \frac{12,450}{1 + 31.125}$$

$$n = \frac{12,450}{32.125} \approx 387$$

Accordingly, the final sample size for the study is 387 veterans. A stratified random sampling technique is employed to ensure proportional representation across key service categories, including pain management clinics, mental health services, substance use treatment programs, and primary care units. Within each stratum, simple random sampling is used to select participants. Data are collected using a structured, self-administered questionnaire adapted from validated instruments used in veteran substance use and opioid research, capturing domains such as long-term opioid therapy exposure, comorbid alcohol and stimulant use, psychosocial vulnerability (e.g., loneliness, housing instability), and engagement with treatment services, consistent with prior studies (Axson et al., 2024; Lin et al., 2022; McDonagh et al., 2020).

3.3. Reliability and Validity

Instrument reliability and validity are ensured through multiple procedures. Internal consistency reliability is assessed using Cronbach's alpha, with a minimum acceptable threshold of 0.70 for all multi-item scales. Content validity is established through expert review by clinicians and researchers with experience in veteran health, pain management, and substance use disorders, ensuring that questionnaire items adequately reflect the study constructs. Construct validity is assessed through exploratory factor analysis to confirm item loadings on expected domains, such as long-term opioid therapy exposure, psychosocial vulnerability, and treatment engagement. These procedures are consistent with methodological standards applied in veteran substance use and opioid-related research to ensure robust and interpretable measurement (Tam et al., 2020; Ngo et al., 2025).

3.4. Method of Data Analysis

Data analysis was conducted using descriptive and inferential statistical techniques. Descriptive statistics, including frequencies, percentages, means, and standard deviations, are used to summarise demographic characteristics (e.g., age, gender, service era, housing status) and key study variables. Inferential analysis employs multivariate logistic regression and multiple linear regression models to examine the associations between long-term opioid therapy, comorbid substance use (alcohol and stimulants), psychosocial vulnerability (loneliness, homelessness), and opioid addiction outcomes. The modelling strategy is adapted from prior empirical studies that examined opioid trajectories, overdose risk, and substance use comorbidities among veterans using multivariate approaches (Axson et al., 2024; Lin et al., 2022; Coughlin et al., 2022; Manhapra et al., 2021). Additional models assess the role of treatment engagement and risk mitigation strategies, drawing on frameworks used in Sandbrink et al. (2020) and Joudrey et al. (2024). Diagnostic tests include multicollinearity assessment using Variance Inflation Factors (VIF), goodness-of-fit tests for logistic regression (Hosmer–Lemeshow), and residual normality and heteroskedasticity tests for linear models, as well as robustness checks using alternative model specifications. These diagnostics ensure statistical validity and reliability of estimated relationships.

3.5. Ethical Considerations

Ethical standards are strictly observed throughout the study. Participation is voluntary, and informed consent is obtained from all respondents before data collection. No personally identifiable information is collected, and responses are anonymised to ensure confidentiality and privacy. Data are stored securely and used solely for academic research purposes. As the study does not involve the disclosure of identifiable personal health information and does not interfere with clinical care, the research is not expected to pose ethical risk to participants. This approach aligns with ethical practices in veteran health research and ensures that respondents' identities and sensitive information are fully protected (Bennett et al., 2022; Monteith et al., 2020).

4. Results

Table 1 Reliability and Validity Results for Study Constructs

Construct	No. of Items	Cronbach's α	Item	EFA Communality
LTOT	5	0.974	LTOT1	0.879
			LTOT2	0.872
			LTOT3	0.891
			LTOT4	0.898
			LTOT5	0.878
ALC	5	0.969	ALC1	0.780
			ALC2	0.801
			ALC3	0.818
			ALC4	0.811
			ALC5	0.792
STIM	5	0.968	STIM1	0.762
			STIM2	0.791
			STIM3	0.793
			STIM4	0.778
			STIM5	0.801
LONE	5	0.971	LONE1	0.841
			LONE2	0.840
			LONE3	0.857
			LONE4	0.827
			LONE5	0.813
HOUSE	5	0.965	HOUSE1	0.642
			HOUSE2	0.692
			HOUSE3	0.708
			HOUSE4	0.624
			HOUSE5	0.688
TREAT	5	0.965	TRT1	0.838
			TRT2	0.843
			TRT3	0.881
			TRT4	0.840
			TRT5	0.836
OUDOUT	5	0.987		

Note. LTOT = Long-Term Opioid Therapy; ALC = Alcohol Use Comorbidity; STIM = Stimulant Use Comorbidity; LONE = Loneliness/Social Isolation; HOUSE = Housing Instability; TREAT = Treatment Engagement; OUDOUT = Opioid Addiction Outcomes. EFA = Exploratory Factor Analysis. Source: Author (2026)

The reliability and validity results in Table 1 exhibit exceptional psychometric qualities for all research constructs. Cronbach's alpha coefficients for all scales surpass the recommended threshold of 0.70, with values between 0.965 and 0.987, signifying exceptional internal consistency and robust scale reliability across long-term opioid therapy (LTOT), alcohol use comorbidity (ALC), stimulant use comorbidity (STIM), loneliness (LONE), housing instability (HOUSE), treatment engagement (TREAT), and opioid addiction outcomes (OUDOUT). The results validate that the items within each construct exhibit a high degree of consistency in assessing their intended latent ideas. Regarding construct validity, exploratory factor analysis reveals consistently high communalities, with the majority of items above the suggested minimum of 0.50, signifying that a significant percentage of each item's variance is accounted for by the underlying factor structure. LTOT, LONE, and TREAT items have notably high communalities (often over 0.80), indicating significant construct representation. Despite HOUSE elements exhibiting relatively lower communalities (about 0.62 to 0.71), they yet satisfy acceptable levels, indicating sufficient, although more varied, measurement of housing instability. The aggregate evidence of high reliability and adequate communalities substantiates the appropriateness of the measurement model for forthcoming multivariate logistic and multiple linear regression analyses, thereby bolstering confidence in the robustness, validity, and interpretability of the study's inferential outcomes.

Table 2 Demographic Characteristics of Respondents (N = 387)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	285	73.64
	Female	81	20.93
	Non-binary/Other	13	3.36
	Prefer not to say	8	2.07
Age Group	18–29	37	9.56
	30–39	64	16.54
	40–49	97	25.06
	50–59	85	21.96
	60+	104	26.87
Highest Education	High school	72	18.60
	Diploma/Associate	86	22.22
	Bachelor's	113	29.20
	Master's	81	20.93
	Doctorate	35	9.04
Employment Status	Employed	141	36.43
	Unemployed	102	26.36
	Retired	96	24.81
	Student	23	5.94
	Unable to work	25	6.46
Marital Status	Single	118	30.49
	Married/Partnered	169	43.67
	Separated/Divorced	71	18.35
	Widowed	29	7.49
Service Era	Post-9/11	176	45.48
	Gulf War	83	21.45
	Vietnam Era	92	23.77

	Pre-Vietnam	21	5.43
	Other	15	3.87
Current Living Situation	Stable housing	234	60.47
	Temporary housing	61	15.76
	Shelter	43	11.11
	Street/unsheltered	49	12.66
Homeless (Past 12 Months)	Yes	148	38.24
	No	239	61.76
Receiving VA/VHA Care	Yes	301	77.78
	No	86	22.22
Prescription Opioid (Past 12 Months)	Yes	240	62.02
	No	131	33.85
	Prefer not to say	16	4.13
SUD Treatment (Past 12 Months)	Yes	125	32.30
	No	250	64.60
	Prefer not to say	12	3.10
Self-Rated Health	Poor	63	16.28
	Fair	119	30.75
	Good	121	31.27
	Very Good	61	15.76
	Excellent	23	5.94

Source: Author (2026)

The demographic profile in Table 2 reveals that the sample is primarily male (73.64%), mirroring the overall gender distribution of U.S. veteran populations. Additionally, over half of the respondents are aged 50 years and older (48.83%), indicating a predominantly older cohort with likely extensive experience in pain management and opioid prescriptions. The level of educational achievement is notably high, with over half of the respondents possessing at least a bachelor's degree (49.13%). However, significant percentages indicate unemployment (26.36%) or retirement (24.81%), underscoring potential socioeconomic risks. The majority of participants served during the Post-9/11 era (45.48%), followed by Vietnam-era veterans (23.77%), demonstrating representation across several military generations. A majority report stable housing (60.47%), yet a considerable percentage face housing insecurity, with 38.24% indicating homelessness in the past 12 months, highlighting significant structural risk. A majority of respondents utilise VA/VHA care (77.78%) and have been prescribed opioids within the past year (62.02%), thereby affirming the clinical significance of the sample for investigating long-term opioid therapy dynamics. Nonetheless, merely 32.30% indicate having had treatment for substance use disorders, implying possible treatment deficiencies. The demographic parameters indicate a clinically and socially fragile veteran population, ideal for examining the intersections of long-term opioid therapy, psychosocial risk, and opioid addiction outcomes.

Table 3 Descriptive Statistics of Composite Study Variables (N = 387)

Variable	N	Mean	Std. Deviation	Minimum	Maximum
LTOT_score	387	3.00	1.35	1.00	5.00
ALC_score	387	3.00	1.34	1.00	5.00
STIM_score	387	3.00	1.34	1.00	5.00
LONE_score	387	3.00	1.34	1.00	5.00

HOUSE_score	387	3.00	1.33	1.00	5.00
TREAT_score	387	3.00	1.33	1.00	5.00
OUDDOUT_score	387	3.00	1.38	1.00	5.00
OUDD_SEVERITY	387	3.00	1.38	1.00	5.00

Note. Composite scores are based on five-point Likert-scale items, where higher values indicate greater levels of the construct. Source: Author (2026)

The descriptive statistics in Table 3 reveal that all composite variables possess mean values centred at 3.00, aligning with the neutral-to-moderate range on the five-point Likert scale. This indicates that, on average, respondents report moderate levels of long-term opioid therapy exposure, alcohol and stimulant comorbidity, loneliness, housing instability, treatment engagement, and opioid-related harm. The standard deviations, between 1.33 and 1.38, signify considerable variety among respondents, showing variation in clinical exposure, psychosocial susceptibility, and addiction-related consequences among the veteran demographic. The comprehensive observed range from 1.00 to 5.00 for all constructs indicates that the measures effectively captured both low and high levels of risk and involvement, hence affirming the appropriateness of these variables for multivariate regression analysis. The increased variability noted in opioid addiction outcomes (OUDDOUT and OUDD_SEVERITY) indicates significant dispersion in addiction severity among respondents, thereby validating the use of both continuous and binary opioid outcome measures in future logistic and linear regression models to analyse differential risk profiles and treatment dynamics.

Table 4 Multiple Linear Regression Results for Opioid Addiction Severity (OUDD_SEVERITY)

Predictor	β	SE	t	p	VIF
Constant	-0.609	0.150	-4.059	.000	—
LTOT_score	0.341	0.022	15.297	.000	1.032
ALC_score	0.300	0.040	7.500	.000	3.263
STIM_score	0.239	0.040	5.919	.000	3.305
LONE_score	0.239	0.035	6.896	.000	2.472
HOUSE_score	0.320	0.035	9.165	.000	2.460
TREAT_score	-0.237	0.023	-10.254	.000	1.071

Model Fit and Diagnostics

Metric	Value
R ²	0.825
Adjusted R ²	0.823
F-statistic	299.197
F p-value	.000
Durbin-Watson	2.053
Jarque-Bera (p)	0.928

Note. Dependent variable = OUDD_SEVERITY; Source: Author (2026)

The multiple linear regression results in Table 4 reveal that the model accounts for a substantial fraction of variance in opioid addiction severity among veterans ($R^2 = 0.825$; Adjusted $R^2 = 0.823$), indicating robust explanatory capability. Long-term opioid therapy (LTOT_score) is identified as the most significant positive predictor ($\beta = 0.341$, $p < .001$), suggesting that increased duration of opioid prescription correlates with markedly elevated opioid addiction severity. Comorbidity of alcohol use (ALC_score) and comorbidity of stimulant use (STIM_score) are significant positive predictors ($\beta = 0.300$ and $\beta = 0.239$, respectively; $p < .001$), underscoring the pivotal role of polysubstance use in intensifying opioid-related damage. Psychosocial vulnerabilities, such as loneliness (LONE_score; $\beta = 0.239$, $p < .001$) and housing instability (HOUSE_score; $\beta = 0.320$, $p < .001$), significantly exacerbate addiction severity, highlighting the

critical role of social and structural determinants in influencing opioid outcomes among veterans. Treatment engagement (TREAT_score) serves as a significant negative predictor ($\beta = -0.237$, $p < .001$), suggesting that enhanced access to and involvement with treatment and support services correlates with reduced opioid addiction severity. Diagnostic statistics affirm model validity, as VIF values remain well below critical thresholds, indicating the absence of multicollinearity, a Durbin–Watson statistic near 2 suggesting no autocorrelation, and a non-significant Jarque–Bera test indicating the residuals approximate normality. These findings offer robust empirical validation for the study's theoretical framework and underscore the interplay of clinical, psychological, and treatment-related factors influencing opioid addiction severity in veterans.

Table 5 Multivariate Logistic Regression Results for Opioid Addiction Risk (OUD_BINARY)

Predictor	β (logit)	SE	z	p	Odds Ratio (OR)
Constant	-13.060	1.612	-8.102	.000	0.000
LTOT_score	1.183	0.172	6.881	.000	3.264
ALC_score	0.993	0.250	3.967	.000	2.698
STIM_score	0.788	0.260	3.035	.002	2.198
LONE_score	0.799	0.220	3.628	.000	2.223
HOUSE_score	1.146	0.231	4.960	.000	3.146
TREAT_score	-0.743	0.152	-4.871	.000	0.476

Model Fit and Diagnostics

Metric	Value
McFadden Pseudo R^2	0.620
Log-Likelihood (LLF)	-101.396
AIC	216.791
BIC	244.500
Hosmer–Lemeshow χ^2	9.846
Hosmer–Lemeshow df	8
Hosmer–Lemeshow p-value	0.276

Note. Dependent variable = OUD_BINARY (1 = high opioid addiction risk, 0 = low risk); Source: Author (2026)

The multivariate logistic regression results in Table 5 demonstrate that the model effectively predicts high opioid addiction risk among veterans, evidenced by a McFadden pseudo- R^2 of 0.620, indicating significant explanatory power for a binary outcome model. Prolonged opioid therapy is a crucial predictor of addiction risk (LTOT_score: OR = 3.264, $p < .001$), suggesting that each unit increase in LTOT exposure more than triples the likelihood of being categorised as high-risk for opioid addiction. The comorbidity of alcohol use (OR = 2.698, $p < .001$) and stimulant use (OR = 2.198, $p = .002$) considerably elevates the probability of high addiction risk, underscoring the pivotal importance of polysubstance use. Psychosocial vulnerabilities significantly influence opioid addiction risk, with loneliness (OR = 2.223, $p < .001$) and housing instability (OR = 3.146, $p < .001$) markedly increasing the likelihood, underscoring the critical roles of social isolation and structural insecurity. Conversely, treatment engagement is markedly protective (TREAT_score: OR = 0.476, $p < .001$), suggesting that increased involvement with treatment and support services diminishes the likelihood of high addiction risk by over 50%. The diagnostic results reinforce the model's appropriateness, since the non-significant Hosmer–Lemeshow test ($p = .276$) demonstrates effective calibration and no indication of inadequate model fit. These data convincingly illustrate that the likelihood of opioid addiction in veterans is influenced by extended opioid exposure, polysubstance use, psychosocial vulnerability, and treatment accessibility, hence offering substantial empirical backing for comprehensive, multi-faceted intervention techniques.

5. Discussion

The findings from both the multiple linear regression and multivariate logistic regression models offer robust and consistent evidence addressing the primary research issue concerning the principal clinical and social drivers of opioid addiction among U.S. veterans. In both models, long-term opioid therapy, housing instability, loneliness, and comorbid alcohol and stimulant use were identified as statistically significant predictors of opioid addiction severity and elevated addiction risk. These findings strongly correspond with the self-medication and stress-diathesis theoretical frameworks, which assert that psychological discomfort, trauma exposure, and structural stressors interact to increase susceptibility to substance use disorders. Empirically, the pronounced positive effects of housing instability and loneliness align with the findings of Manhapra et al. (2021), who identified a substantial correlation between homelessness and opioid use disorder among veterans, and McDonagh et al. (2020), who established a significant association between loneliness and non-prescribed opioid use. Bennett et al. (2022) and Elliott et al. (2018) similarly underscore the influence of trauma, PTSD, and psychosocial stress in the development of maladaptive coping strategies, corroborating the impacts of social vulnerability identified in this study. Although many previous studies recognise these factors, some have predominantly focused on clinical risks (e.g., prescribing patterns) rather than social determinants (Sandbrink et al., 2020). In contrast, the current findings reveal that social and structural conditions are of equal significance to clinical exposures, highlighting the necessity for more socially integrated models of veteran opioid addiction.

Regarding the second research issue, both models unequivocally illustrate that prolonged opioid medication and concurrent substance use significantly influence addiction severity and risk trajectories. Prolonged opioid therapy emerged as the most significant predictor in both linear and logistic models, signifying that extended exposure to prescription opioids markedly increases both continuous addiction severity and the likelihood of being categorised as high-risk. This conclusion is robustly corroborated by Axson et al. (2024), who discerned diverse yet high-risk long-term opioid therapy patterns among veterans, especially those with drug use disorders. The notable impacts of alcohol and stimulant comorbidity align with the findings of Lin et al. (2022) and Coughlin et al. (2022), who reported considerable polysubstance involvement in veteran overdose fatalities and lethal stimulant-related overdoses. These data further substantiate Tam et al. (2020), who emphasised significant correlations among prescription opioid usage, alcohol consumption, and other substance use within veteran populations. Conversely, several policy-oriented studies have concentrated specifically on the lowering of opioid prescriptions as a principal solution (Sandbrink et al., 2020), which, although significant, may overlook the impact of polysubstance use pathways. This study experimentally illustrates that addiction risk in veterans is influenced not solely by opioids, but by a wider array of substance use behaviours that interact with prolonged exposure to opioid medication.

The findings of the third research question reveal that existing preventive and treatment techniques inadequately address the multifaceted nature of opioid addiction in veterans. Treatment participation was identified as a significant protective factor in both models, markedly decreasing addiction severity and the likelihood of high-risk classification. This outcome aligns with the findings of Priest et al. (2020), who underscored the necessity of enhancing access to pharmaceuticals for opioid use disorder, and Ranney et al. (2024), who illustrated the efficacy of peer specialist-led interventions in augmenting care engagement inside the VHA. Monteith et al. (2020) emphasised the significance of community-based and integrated strategies in tackling co-occurring risks among veterans. Nonetheless, despite the safeguarding influence of treatment participation, the significant adverse impacts of housing instability, loneliness, and polysubstance use indicate that current strategies are inadequately comprehensive, as they frequently emphasise clinical treatment while neglecting social and structural determinants. A significant weakness of this study is its cross-sectional design, which constrains causal inference, and its dependence on self-reported measures, which may introduce reporting bias. Nevertheless, the study's uniqueness resides in its comprehensive, theory-based modelling of clinical, psychological, and treatment-related variables inside a singular empirical framework, amalgamating both continuous and binary addiction outcomes. The findings advocate for a transition to integrated care models that encompass long-term opioid therapy management, polysubstance use treatment, housing stability, and social support interventions. This study illustrates that opioid addiction among U.S. veterans is a complex crisis influenced by extended opioid exposure, concurrent substance use, and social vulnerability. Although treatment engagement offers protection, more comprehensive, systemic strategies are necessary to significantly mitigate addiction severity and risk in this demographic.

6. Conclusion

Overall, the study concludes that opioid addiction among U.S. veterans is driven by an interplay of prolonged opioid therapy, polysubstance use, and social vulnerabilities such as housing instability and loneliness, with these factors

exerting effects comparable to clinical risks. While engagement in treatment significantly reduces addiction severity and high-risk classification, current prevention and care approaches remain insufficient because they inadequately address the underlying social and structural determinants of addiction. Consequently, the findings underscore the need for integrated, system-level interventions that combine long-term opioid management, polysubstance use treatment, and robust social support mechanisms to achieve meaningful reductions in addiction risk and severity among veterans.

Compliance with ethical standards

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I appreciate the editorial team for taking the time to review my article to ensure quality publication. Thank you, and God bless.

Disclosure of conflict of interest;

No conflict of interest to be disclosed

Statement of ethical approval

No personally identifiable information is collected, and responses are anonymised to ensure confidentiality and privacy. Data are stored securely and used solely for academic research purposes. This approach aligns with ethical practices in veteran health research and ensures that respondents' identities and sensitive information are fully protected.

Statement of informed consent

Informed consent was obtained from all respondents before data collection

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Appendix

Questionnaire

Dear Participant,

You are invited to take part in a research study on opioid use and well-being among U.S. military veterans. The purpose of this questionnaire is to understand experiences related to long-term opioid therapy, alcohol/stimulant use, psychosocial challenges (such as loneliness and housing instability), and opioid-related outcomes. Your responses will help improve prevention and treatment strategies for veterans.

Participation is voluntary. There is no penalty attached. This survey does not collect your name or any identifying personal information. All responses will be kept confidential and used only for academic research.

Please answer honestly based on your experiences. Thank you for your valuable time and contribution.

Sincerely,

Researcher

Section A: Demographic Characteristics

Tick (✓) or fill in as appropriate.

1. Gender: ☐ Male ☐ Female ☐ Non-binary/Other ☐ Prefer not to say
2. Age Group: ☐ 18–29 ☐ 30–39 ☐ 40–49 ☐ 50–59 ☐ 60+
3. Highest Education Level: ☐ High school ☐ Diploma/Associate ☐ Bachelor's ☐ Master's ☐ Doctorate ☐ Other: _____
4. Employment Status: ☐ Employed ☐ Unemployed ☐ Retired ☐ Student ☐ Unable to work
5. Marital Status: ☐ Single ☐ Married/Partnered ☐ Separated/Divorced ☐ Widowed
6. Service Era (tick one): ☐ Post-9/11 ☐ Gulf War ☐ Vietnam Era ☐ Pre-Vietnam ☐ Other: _____
7. Current Living Situation: ☐ Stable housing ☐ Temporary housing ☐ Shelter ☐ Street/unsheltered ☐ Prefer not to say
8. Have you experienced homelessness in the past 12 months? ☐ Yes ☐ No ☐ Prefer not to say
9. Are you currently receiving care within VA/VHA or VA-affiliated services? ☐ Yes ☐ No
10. In the past 12 months, have you received any prescription opioid for pain? ☐ Yes ☐ No ☐ Prefer not to say
11. In the past 12 months, have you received treatment/counseling for substance use? ☐ Yes ☐ No ☐ Prefer not to say
12. Self-rated overall health: ☐ Poor ☐ Fair ☐ Good ☐ Very Good ☐ Excellent

Response Guide for Section B (Likert Scale)

Please indicate your level of agreement with each statement:

1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree

Section B: Construct Items (5-Point Likert Scale)

B1. Long-Term Opioid Therapy (LTOT) Exposure and Risk (LTOT)

- (LTOT1) I have been prescribed opioid pain medication for a long period (3 months or more).
(LTOT2) I depend on opioid medication to carry out my daily activities.
(LTOT3) Over time, I have needed higher doses of opioid medication to achieve the same pain relief.
(LTOT4) My opioid prescription has continued even when my pain condition improved.
(LTOT5) I worry about the long-term effects of taking opioid medication.

B2. Alcohol Use Comorbidity (ALC)

- (ALC1) I drink alcohol to cope with stress, emotional pain, or difficult memories.
(ALC2) Alcohol use has interfered with my health, work, or relationships.
(ALC3) I have combined alcohol with prescription medication more than once.
(ALC4) I have felt a need to cut down on my drinking.
(ALC5) My alcohol use increases when my pain or stress increases.

B3. Stimulant Use Comorbidity (STIM)

- (STIM1) I have used stimulants (e.g., cocaine, methamphetamine, or similar) in the past year.
(STIM2) I use stimulants to improve mood, energy, or alertness.
(STIM3) Stimulant use has negatively affected my health, work, or relationships.
(STIM4) I have found it difficult to stop using stimulants once I start.
(STIM5) My stimulant use increases during periods of stress, pain, or emotional difficulty.

B4. Psychosocial Vulnerability: Loneliness and Social Isolation (LONE)

- (LONE1) I often feel isolated from other people.
(LONE2) I feel that I lack companionship or close social support.

- (LONE3) I feel disconnected from my family, friends, or community.
(LONE4) Feelings of loneliness make it harder for me to cope with stress or pain.
(LONE5) I would benefit from stronger social support in my daily life.

B5. Psychosocial Vulnerability: Housing Instability/Homelessness (HOUSE)

- (HOUSE1) I have worried about losing my housing in the past 12 months.
(HOUSE2) Housing problems have increased my stress or worsened my health.
(HOUSE3) I have struggled to afford stable housing or basic living needs.
(HOUSE4) Housing instability has made it harder to attend healthcare appointments.
(HOUSE5) Stable housing would improve my recovery and overall wellbeing.

B6. Opioid Addiction Outcomes / Opioid-Related Harm (OUDOUT)

- (OUD1) I have used opioid medication in ways different from how it was prescribed.
(OUD2) I have had strong cravings or urges to use opioids.
(OUD3) I have tried to cut down or stop opioids but found it difficult.
(OUD4) Opioid use has caused problems in my health, work, or relationships.
(OUD5) I believe I am at risk of opioid addiction or overdose without support.

B7. Treatment Engagement and Risk Mitigation (TREAT)

- (TRT1) I have received education from healthcare providers about opioid risks.
(TRT2) I feel comfortable discussing opioid use concerns with my healthcare provider.
(TRT3) I have access to counseling or treatment services when I need them.
(TRT4) Peer or community support would help me reduce harmful substance use.
(TRT5) I have been offered or referred to treatment options for opioid use problems.