

Lean/Sizzurp Ingredients, Use, and Coping With Mental Health Symptoms

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Substance Abuse: Research and Treatment
Volume 17: 1–9
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DOI: 10.1177/11782218231195226



ABSTRACT: The substance combination of codeine and promethazine, commonly termed *lean/sizzurp*, has been identified as a method that some individuals use to cope with PTSD and other mental health symptomology. A sample of 1423 adults with self-reported past year lean use was recruited from substance-related Reddit pages to complete a survey about lean, including information about using lean to cope with emotions, thoughts, or feelings. To be included in the sample, persons needed to: (1) be ≥ 18 years old, (2) report past year lean use, (3) complete lean use screeners, and (4) pass data quality checks (eg, bot detection). As Reddit is an online forum, no geographic restrictions were placed on study participation. Data on demographic characteristics, lean use, and mental health disorder symptomology were captured from participants. Logistic regression models included anxiety, depression, and trauma as independent variables along with covariates to examine using lean to cope with emotions, thoughts, or feelings in the past 30 days. Most participants were male ($n = 1102$; 77.4%), with an average age of 26.9 ($SD = 5.2$) years. Most participants used included codeine as an ingredient in lean ($n = 1060$; 74.5%); promethazine was added as an ingredient by 31.7% of the sample ($n = 451$), and the combination of codeine and promethazine was included as ingredients by 13.5% ($n = 192$) of the sample. Participants with anxiety, lifetime trauma exposure, and who were female had increased odds of using lean to cope with emotions, thoughts, or feelings in the past 30 days. Those with depression and unstable housing exhibited decreased odds of using lean to cope with emotions, thoughts, or feelings in the past 30 days. This study recruited persons via social media to learn more about lean use, especially lean use to cope with mental health symptoms; future population-level studies are needed.

KEYWORDS: Codeine, lean, mental health, promethazine, PTSD, substance use

RECEIVED: May 30, 2023. **ACCEPTED:** July 31, 2023.

TYPE: Original Research

FUNDING: The author received no external financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Introduction

Lean or *sizzurp* is a cough syrup liquid mixture of codeine and promethazine (sometimes called barre, purple drank, amongst other names).^{1–5} Due to the unpleasant taste,⁶ sweeteners such as soda or candy are often added to lean before consumption.^{2,7,8} Lean is prominent in popular culture, especially music, in which numerous songs have described lean consumption.^{4,9–12} Because lean is highly visible in popular culture, the scarce research to date on this substance combination is concerning, particularly given the evidence that some persons could develop a substance use disorder (SUD) from consuming lean.^{2,4,9,13}

Despite the available evidence on lean, which identifies its potential for health consequences,^{2,4,9,13} there is not much research on the overall prevalence of lean use.⁴ Some studies based on the prevalence of lean use in study samples within specific geographic regions exist.^{1,4,8,9} For example, a study among college students in the southeastern United States found that approximately 6.5% of the sample ever consumed lean.^{1,8} Another study examining data captured from electronic dance music party attendees in New York City found that 15.5% of the sample ever consumed lean.⁹ Data on medical diversion appear to highlight the use of lean. Among a sample of pharmacies in France, codeine and promethazine were reported as the most requested substances that pharmacists suspected of being used for means other than prescribed, especially among young adults.³ Adolescents and young adults may be at risk of misusing codeine and promethazine^{2,5} due to social

networks,¹⁰ internet usage, and popular culture.^{3,7,9,13,14} Different groups across genders, ethnic groups, sexual orientations, and racial groups have been shown to consume lean.^{1,4,9,10,15}

Although lean is being used recreationally,^{9,16,17} there is the potential for side effects, toxicity, health risks, developing a SUD,^{2,4,13} and overdose.^{5,9,13,14,18,19} Indeed, potential adverse events from drinking lean include drowsiness, hallucinations, neuropsychological complications, respiratory depression, and even death.^{2,11,13,14,18,19} One of the substances in lean is codeine, an opioid that places individuals at risk of overdose.^{13,14}

Notably, along with recreational use, lean consumption has been identified both in music¹¹ and in the academic literature²⁰ as a method that some individuals use to cope with PTSD and other mental health symptomology. A research correspondence described the importance of examining factors related to lean use, especially lean use associated with coping with trauma or stressors.²⁰ Although no studies to date have used clinical or survey data to examine individuals specifically using lean to cope with mental health symptoms, other evidence suggests that substances are sometimes used to cope with distress.^{21,22} Therefore, learning more about individuals using lean to cope with mental health symptomology is critical for effective intervention planning and prevention efforts. Investigating the use of lean overall alongside individuals using it to cope has importance because not much is known about the broader societal impacts, current treatment trends, and treatment gaps.



This cross-sectional exploratory study was conducted to use self-reported survey data to learn more about (1) lean ingredients (to learn more about the proportion of individuals that include codeine, promethazine, or other ingredients in lean), (2) lean use frequency (how often lean was consumed in the past 12 months), (3) lean use disorder screening criteria (completing exploratory screeners that could potentially identify at-risk lean use), and (4) the association between anxiety, depression, and PTSD symptomology with using lean to cope (to learn more about persons using lean to cope with emotions, thoughts, or feelings related to mental health symptoms) among adults who reported lean use in the past 12 months. This study sought to increase the knowledge base on lean by collecting survey data online from adults in substance use and substance-related subReddits (discussed in the Methods section) from October 2022 to January 2023. Findings from this study are needed for clinical²⁰ and research purposes primarily for treatment interventions.

Methods

Recruitment and procedures

All study procedures were approved by the University of North Carolina at Chapel Hill Institutional Review Board; Principal Investigator [PI]: Ware, Reference ID: 370263. Participants were recruited from Reddit, a highly popular online content and discussion forum. The PI sent messages to 21 moderators (individuals who manage/monitor forums on Reddit) of subReddits (ie, subject-specific forums), 20 of which focused on substances and 1 of which focused on music, to gain permission to post recruitment materials to these subReddits. The specific names of the subReddits are not listed in the current paper to follow the wishes of some of the subReddit moderators. If the moderators did not respond after the first message, they were sent at least one more follow-up message after 10 days. Ten subReddit page moderators did not respond, five declined, two asked for payment from the PI to post recruitment materials (which the PI was unable to accommodate and declined), and four provided approvals to post recruitment materials.

One of the subReddit moderators that provided approval gave access to recruit from 3 other substance-related subReddits not initially contacted by the PI. After receiving moderator approval, recruitment materials were posted to a total of 7 subReddits focused on substances approximately once per week from October 2022 to November 2022 on a rolling basis. Recruitment materials included a flyer with the study's description, brief eligibility criteria, the IRB study number, the PI's contact information, a QR code directing individuals to the study survey on Qualtrics,²³ the full link for the survey on Qualtrics, and incentive information (ie, survey completers entering a drawing in which everyone had equal odds of receiving 1 of 20 \$50 electronic gift cards). Some subReddits did not allow posts that included images. In these instances, the post would only include the wording from the survey flyers without

a QR code. The survey, survey link, and QR code were active until early January 2023. Using features in Qualtrics,²³ responses were anonymized (no location data was collected), and bot detection was activated (reCAPTCHA).

After using the QR code or full link, persons interested in the study were taken to the survey in Qualtrics. The first page included a description of the study (a one-time 20-minute anonymous online survey), the voluntary nature of the survey, IRB contact information, PI contact information, and a prompt asking if individuals were interested in completing the eligibility screening questions. Individuals (1) at least 18 years old, (2) who responded *yes* to "Have you ever used lean? Sometimes it is called purple, purple drank, double cup, sizzurp, or dirty sprite," (3) and who responded accurately to a quality check question were eligible to participate. The quality check question was, "I will answer these questions," with response options "Truthfully" and "Untruthfully."

Ineligible respondents were notified of their ineligibility and thanked for their time. Eligible respondents were notified of their eligibility and asked if they would like to participate in the study. Eligible respondents who declined were thanked for their time and exited from the webpage, while eligible respondents who elected to participate started the survey. Participants who completed the survey were informed of the next steps regarding the incentive, given a four-digit number, and provided a link for a separate Qualtrics survey to add their e-mail addresses for the incentive drawing. This incentive survey asked participants for the code they were provided in the study survey, their e-mail addresses, and if they were willing to be contacted for future studies. Separating these surveys allowed for study survey responses to be unlinked from e-mail addresses. The electronic gift card incentives were dispensed by e-mail after the data collection period by using a random number generator to select incentive recipients. Individuals selected to receive incentives who did not respond to 3 e-mails from the PI sent over 4 weeks were replaced by another individual who was selected randomly.

Measures

Demographics. Demographic data captured include age, employment status, gender, housing status, race/ethnicity, and sexual identity.

Age. Age was determined by asking respondents, "What is your age in years?" They were then able to select numerical responses that ranged from 18 to 75, or categorical responses, "younger than 18 years old" and "older than 75 years old." Selecting "younger than 18 years old" was study exclusion criteria as described in the recruitment and procedures section above.

Employment status. Employment status was determined by asking respondents, "What best describes your employment status?" Participants could select one of the following options: (a) disabled or unable to work, (b) employed full-time, (c) employed part-time, (d) unemployed, or (e) student.

Gender. Gender identity was identified by asking respondents, “How do you describe yourself?” Participants could select one of the following options: (a) male/man, (b) female/woman, (c) transgender male/man, (d) transgender female/woman, (e) genderqueer, gender non-conforming, or non-binary, and (f) different identity. During data analysis, some cases were combined into the category of Other gender identity due to small cell sizes.

Housing status. Housing status was determined by respondents answering the following question “What is your housing situation today?” with response options including: (a) I have housing, (b) I have housing today, but I am worried about losing housing in the future, and (c) I do not have housing (I am staying with others, in a hotel, in a shelter, living outside on the street, on a beach, in a car, abandoned building, bus or train station, or in a park).²⁴

Race/ethnicity. Race/ethnicity was determined by 2 questions. For the first question, which asked, “What best describes your ethnicity?,” respondents could select (1) Hispanic or Latino or (2) Non-Hispanic or Latino. For the second question, which asked, “What best describes your race? (please select all that apply),” respondents could select any of the following responses: (1) American Indian or Alaska Native, (2) Asian, (3) Black or African American, (4) Native Hawaiian or Other Pacific Islander, (5) White, and (6) Other (please describe). During data analysis, race and ethnicity variables were combined. Some responses were combined into a category called Other Race and Ethnicity due to small cell sizes.

Sexual identity. Sexual identity was identified by asking respondents, “Which of these best describes your current sexual orientation?” and to select 1 of the following options: (a) Asexual, (b) Bisexual, (c) Gay or Lesbian, (d) Heterosexual or Straight, (e) Pansexual, and (f) Queer. Some cases were combined into the category of Other Sexual Identity due to small cell sizes.

Hospital anxiety and depression scale. The Hospital Anxiety and Depression Scale (HADS), is a brief standardized 14-item measure used to screen for anxiety and depression symptoms.²⁵ Seven items focus on anxiety and 7 focus on depression. There are 4 responses per item with values ranging from 0 to 3. Possible scores for the separate anxiety and depression subscales range from 0 to 21, with 2 cutoffs: (1) 0 to 7: Normal and (2) ≥ 8 : Anxiety or Depression Risk.²⁵ A sample item for the anxiety subscale is “I feel tense or ‘wound up’” and, for the depression subscale, “I still enjoy the things I used to enjoy.”²⁵ The HADS was used for this study because it is relatively brief and has been shown to be a reliable and valid measure in other studies.²⁵⁻³⁰ The Cronbach alpha for the anxiety and depression subscales in this sample were $\alpha = .63$ and $\alpha = .49$, respectively. The Cronbach alpha for the full 14-item measure is $\alpha = .66$.

Primary care PTSD screen. The Primary Care PTSD Screen for DSM-5 (PC-PTSD-5), is a brief standardized 5-item

measure with an extra lead-in question used to screen for PTSD.³¹ The lead-in question establishes if the respondent has ever experienced a traumatic event (ie, lifetime trauma exposure). If the respondent answers No to the lead-in question, the survey ends. If the respondent answers yes, they complete 5 items with binary response options, Yes (scored as 1) and No (scored as 0). Total scores for this measure range from 0 to 5, with higher scores indicating a higher risk of PTSD.³¹ A sample item is, “In the past month, have you had nightmares about the event(s) or thought about the event(s) when you did not want to?”³¹ Previous research has identified this measure as an effective diagnostic screener for PTSD among a sample of veterans.³¹ The PC-PTSD-5 measure used for this study because it is relatively brief, has been identified as easy to understand, and is effective in accurately identifying individuals at risk of PTSD.³¹ The Cronbach alpha for the 5 items in this sample was $\alpha = .58$.

Lean ingredients. To identify the ingredients in a respondent’s lean mixture, they were asked, “What ingredients are in your lean (please select all that apply)?” Participants could select any of 3 response options: (a) codeine, (b) promethazine, and (c) other ingredients.

Lean to cope. Participants were asked 2 questions: “Have you ever used lean to cope with physical pain?” and “Have you ever used lean to cope with emotions, thoughts, or feelings?” Both items had binary values (yes and no). If respondents answered yes to the item on coping with emotions, thoughts, or feelings, they were asked a follow-up question, “Have you used lean to cope with emotions, thoughts, or feelings in the last 30 days?” This item also had yes and no binary response options.

Lean use disorder identification test. The Lean Use Disorder Identification Test (LUDIT) is a 3-item measure that was adapted from the Alcohol Use Disorders Identification Test-Concise³² for this study. Items were changed to mention lean instead of alcohol. These items may be found in Supplemental Screener 1. Specific items and response options include: (1) “How often did you drink lean in the past year?” (Never = 0; Monthly or less = 1; 2 to 4 times a month = 2; 2 to 3 times per week = 3; 4 or more times a week = 4); (2) “How many drinks containing lean did you have on a typical day in the past year?” (1 or 2 drinks = 0; 3 or 4 drinks = 1; 5 or 6 drinks = 2; 7 to 9 drinks = 3; 10 or more drinks = 4); and (3) “How often did you have 3 or more drinks of lean on 1 occasion in the past year?” (never = 0; less than 1 = 1; monthly = 2; weekly = 3; daily or almost daily = 4). Respondents that answered *Never* to the first item were not asked the 2 follow-up questions. Possible total scores ranged from 0 to 12 with higher scores indicating a higher risk for lean use disorder. All individuals in this current analysis selected a response other than *Never* for the first question of the LUDIT. The Cronbach alpha for the 3 items in this sample was $\alpha = .55$.

Lean use disorder. The Lean Use Disorder (LUD) measure is an 11-item measure that was adapted from the 11 substance use disorder symptoms listed in the *Diagnostic and Statistical Manual of Mental Disorders* Fifth Edition Text Revision (DSM-5-TR)³³ for this study. The 11 DSM-5-TR symptoms were asked in relation to their lean use. The items may be found in Supplemental Screener 2. Respondents selected yes (value = 1) or no (value = 0) to experiencing 11 SUD symptoms related to their lean use in the last 12 months, with possible total scores ranging from 0 to 11. The following clinical cutoffs from the DSM-5-TR were used to identify past 12 month LUD: (a) a score of 0 to 1 (no LUD); (b) a score of 2 to 3 (mild LUD); (c) a score of 4 to 5 (moderate LUD); and (d) a score of ≥ 6 (severe LUD).³³ A sample item is, "In the last 12 months, have you used lean in large amounts or over longer periods of time than intended?"³³ The Cronbach alpha for this sample is $\alpha = .59$.

Lean past 30-day use. Respondents were asked the following question, which had binary yes no response options: "Have you used lean in the last 30 days?"

Sample

The dataset downloaded from Qualtrics contained a total of 2883 cases. Exclusionary criteria led to $n = 1046$ cases being excluded using Qualtrics' bot detection feature, $n = 301$ excluded for not meeting the survey eligibility screening, $n = 9$ eligible persons excluded for not selecting Yes to study participation, and $n = 104$ excluded for not meeting criteria for the current analyses. The final analytic sample was 1423 individuals (Supplemental Figure 1).

Analysis

Analyses were conducted using IBM SPSS Statistics Version 28.0³⁴ in a Secure Research Workspace provided by the University of North Carolina at Chapel Hill's Information Technology Services. Univariate statistics were used to describe the study sample. Bivariable analyses were used to examine associations between variables and measures. Multivariable analyses included logistic regression models. The first binary logistic regression model included "Using Lean to Cope with Emotions, Thoughts, or Feelings in the Past 30 days" as the dependent variable and the presence of anxiety, depression, and lifetime trauma exposure as independent variables. Age, gender (Reference group [Ref]: Male/Man), and housing status (Ref: I have housing) were added as covariates. The independent variables and covariates were entered simultaneously into the model to examine adjusted odds ratios (AORs). The presence of anxiety, depression, and lifetime trauma exposure were also added separately to examine the unadjusted odds ratios. Anxiety and depression variables were missing 4.4% of data and the lean to cope with emotions in the past 30 days variable was missing <1% of data. Little's test for Missing Completely

at Random (MCAR) revealed that the data were not MCAR ($P < .001$). Therefore, 5 multiple imputations were conducted to address missingness, and pooled results from all multivariate analyses are described in this paper.

After selecting individuals with a lifetime trauma exposure ($n = 524$), a second logistic regression model included "lean to cope with emotions, thoughts, or feelings in the past 30 days" as an outcome, the PTSD screen score as an independent variable, and the covariates from the first logistic regression model to examine each variable's AOR. The PTSD screen was also added separately to examine the unadjusted odds ratio.

Results

Sample characteristics

Table 1 provides sociodemographic, mental health, and lean use characteristics of the full analytical sample ($N = 1423$). Most participants were employed full-time ($n = 964$; 67.7%), Male/Men ($n = 1102$; 77.4%), and have housing ($n = 813$; 57.1%). The sample had an average age of 26.9 years ($SD = 5.2$).

Lean use

Most respondents used lean in the past 30 days (91.1%) and met the screening criteria of having severe lean use disorder ($n = 1117$; 78.5%). An independent samples *t*-test identified individuals who met the criteria for a LUD (regardless of severity) ($M = 4.2$; $SD = 1.9$) had significantly ($P < .05$) higher scores than those not meeting the criteria for a LUD ($M = 3.4$; $SD = 2.1$) on the LUDIT. Regarding ingredients, most of the sample included codeine as an ingredient in their lean ($n = 1060$; 74.5%). Less than one-third of the sample ($n = 451$; 31.7%) added promethazine as an ingredient to their lean.

Anxiety, depression, trauma exposure, and lean to cope

Table 2 shows results of the first logistic regression model. In the adjusted model, anxiety (AOR = 2.36; $P < .001$; 95% Confidence Interval [CI] = [1.67, 3.34]), lifetime trauma of exposure (AOR = 5.58; $P < .001$; 95% CI = [4.33, 7.20]), and being Female/Woman (AOR = 1.71; $P < .001$; 95% CI = [1.27, 2.31]) compared to being Male/Man had increased odds of using lean to cope with emotions, thoughts, or feelings in the past 30 days. However, depression (AOR = 0.47; $P < .001$; 95% CI = [0.34, 0.66]) and unstable housing (AOR = 0.68; $P = .004$; 95% CI = [0.52, 0.88]) compared to stable housing had decreased odds of using lean to cope with emotions, thoughts, or feelings in the past 30 days.

PTSD and lean to cope

Table 3 shows the results of the second logistic regression model. In the adjusted model, higher scores on the PTSD severity screener (AOR = 1.90; $P < .001$; 95% CI = [1.60, 2.26])

Table 1. Sociodemographic, mental health and lean use characteristics of the sample.

CHARACTERISTIC	N	%	MEAN	SD
Sample	1423	100.0		
Age			26.9	5.2
Employment status				
Disabled or unable to work	24	1.7		
Employed full-time	964	67.7		
Employed part-time	371	26.1		
Unemployed	32	2.2		
Student	32	2.2		
Gender identity				
Male/man	1102	77.4		
Female/woman	290	20.4		
Other gender identity	31	2.2		
Housing status				
I have housing	813	57.1		
Unstable housing	549	38.6		
I do not have housing	61	4.3		
Race and ethnicity				
American Indian or Alaska native	25	1.8		
Black or African American	145	10.2		
Native Hawaiian or Other Pacific Islander	88	6.2		
White	644	45.3		
Hispanic or Latino any race	437	30.7		
Other race and ethnicity	84	5.9		
Sexual identity				
Asexual	57	4.0		
Bisexual	78	5.5		
Gay or lesbian	58	4.1		
Heterosexual or straight	1211	85.1		
Other sexual identity	19	1.3		
Lean ingredients				
Codeine only	846	59.5		
Promethazine only	244	17.1		
Codeine and promethazine	138	9.7		
Other ingredients	104	7.3		
Codeine and other ingredients	22	1.5		
Promethazine and other ingredients	15	1.1		
Codeine, promethazine, and other ingredients	54	3.8		

(Continued)

Table 1. (Continued)

CHARACTERISTIC	N	%	MEAN	SD
Past year lean use				
Monthly or less	617	43.4		
2 to 4 times a month	589	41.4		
2 to 3 times per week	167	11.7		
4 or more times a week	50	3.5		
Past 30d lean use				
No	127	8.9		
Yes	1296	91.1		
Lean use disorder (LUD) ^a				
Does not meet LUD criteria	50	3.5		
Mild LUD	71	5.0		
Moderate LUD	185	13.0		
Severe LUD	1117	78.5		
Lean to cope with emotions, thoughts, or feelings				
Never	219	15.4		
Yes, ever but not in the past 30d	576	40.5		
Yes, in the past 30d	615	43.2		
Missing	13	0.9		
Lean to cope with physical pain				
Never	272	19.1		
Yes, ever	1138	80.0		
Missing	13	0.9		
Lean use disorder identification test ^b			4.2	1.9
Lean use disorder ^a			6.6	2.2
HADS-anxiety score ^c			9.9	3.1
HADS-depression score ^d			9.4	2.8
PC-PTSD-5 score ^e			4.1	1.2
Anxiety ^c	1093	76.8		
Depression ^d	1112	78.1		
Anxiety and depression ^{c,d}	955	67.1		
Lifetime trauma exposure	524	36.8		

Abbreviation: SD, standard deviation.

^aEleven-item measure adapted from the DSM-5-TR. Scores: (a) 0 to 1 no LUD, (b) 2 to 3 mild LUD, (c) 4 to 5 moderate LUD, and (d) ≥ 6 severe LUD. Range: 0 to 11.

^bThree-item measure adapted from the AUDIT-C. Range: 0 to 12.

^cHospital anxiety and depression scale: anxiety subscale. Scores: (a) 0 to 7 normal and (b) ≥ 8 anxiety. Range: 0 to 21.

^dHospital anxiety and depression scale: depression subscale. Scores: (a) 0 to 7 normal and (b) ≥ 8 depression. Range: 0 to 21.

^ePrimary care PTSD screen. Range: 0 to 5.

had increased odds, and being Female/Woman (AOR=0.64; $P=.048$; 95% CI=[0.41, 1.00]) compared to being Male/Man had decreased odds of using lean to cope with emotions, thoughts, or feelings in the past 30 days.

Discussion

Although lean is consumed internationally,^{3,16,20} and has visibility in popular culture,^{4,9-12} it remains vastly understudied. This exploratory study focused on gaps in the literature

Table 2. Binary logistic regression model examining the impact of anxiety, depression, and trauma exposure on using lean to cope with emotions, thoughts, or feelings in the past 30 days.

	UNADJUSTED			ADJUSTED		
	UNADJUSTED ODDS RATIO	P-VALUE	95% CONFIDENCE INTERVAL	ADJUSTED ODDS RATIO	P-VALUE	95% CONFIDENCE INTERVAL
Anxiety (Ref: No)						
Yes	2.61***	<.001	1.95, 3.49	2.36***	<.001	1.67, 3.34
Depression (Ref: No)						
Yes	0.67**	.004	0.51, 0.88	0.47***	<.001	0.34, 0.66
Lifetime trauma exposure (Ref: No)						
Yes	6.41***	<.001	5.04, 8.16	5.58***	<.001	4.33, 7.20
Age				1.02	.078	1.00, 1.05
Gender (Ref: Male/man)						
Female/woman				1.71***	<.001	1.27, 2.31
Other gender Identity				1.01	.977	0.45, 2.26
Housing status (Ref: I have housing)						
Unstable housing				0.68**	.004	0.52, 0.88
I do not have housing				1.20	.550	0.66, 2.21

The results are pooled from 5 imputations to address 4.4% of data missing.

Abbreviation: Ref, reference group.

N=1423.

** $P < .01$. *** $P < .001$.

Table 3. Binary logistic regression model examining the impact of PTSD on using lean to cope with emotions, thoughts, or feelings in the past 30 days.

	UNADJUSTED			ADJUSTED		
	UNADJUSTED ODDS RATIO	P-VALUE	95% CONFIDENCE INTERVAL	ADJUSTED ODDS RATIO	P-VALUE	95% CONFIDENCE INTERVAL
PTSD severity	1.85***	<.001	1.56, 2.19	1.90***	<.001	1.60, 2.26
Age				1.02	.306	0.99, 1.05
Gender (Ref: Male/Man)						
Female/woman				0.64*	.048	0.41, 1.00
Other gender identity				0.92	.874	0.34, 2.49
Housing status (Ref: I have housing)						
Unstable housing				0.74	.173	0.48, 1.14
I do not have housing				1.11	.788	0.51, 2.44

Results are pooled from 5 imputations to address <1% of data missing.

N=524 individuals with a trauma exposure in their lifetime.

Abbreviation: Ref, reference group.

* $P < .05$. *** $P < .001$.

regarding (1) respondent descriptions of lean ingredients, (2) lean use frequency, (3) lean use disorder screening criteria, and (4) persons consuming lean to cope with anxiety, depression, and PTSD symptomology.

Most individuals in this sample reported codeine as the only ingredient (60%) followed by promethazine only (17.1%). The combination of codeine and promethazine was added as ingredients in lean by 13.5% of the sample ($n = 192$). Regardless of

other substances that were added, approximately three-fourths of individuals reported codeine as an ingredient. Although the mixture of codeine and promethazine is the typical description of lean,¹⁻⁵ substance availability could affect this. Further, peer, cultural, or geographic norms related to substance use may have an impact on what ingredients must be incorporated to meet the description of lean. One study which captured data from electronic dance music attendees found that 75% of individuals believed their lean ever included codeine as an ingredient and 32% believed it usually or always included codeine as an ingredient.⁹ Considering codeine and promethazine are suspected of being diverted by some pharmacists,³ some persons may only be able to access one ingredient (either codeine or promethazine) and not the other. This current study further specifies the need to identify which ingredients persons self-report as being in their lean.

Most people in our sample drank lean monthly or less, or 2 to 4 times a month. Over three-fourths of the sample met the screening criteria for severe lean use disorder. Considering codeine was the most reported ingredient in lean in this sample, individuals presenting to treatment and meeting the SUD criteria for lean should be screened for the need for opioid withdrawal treatment.³⁵

Individuals in this sample with greater depression severity had lower odds of using lean to cope in the past 30 days. However, those with greater anxiety or PTSD severity were more likely to use lean to cope with emotions, thoughts, or feelings in the past 30 days. Therefore, treatments for co-occurring mental health and substance use disorder symptomology should be provided simultaneously if individuals are identified as having a mental health symptomology and a SUD.²⁰

Most of the sample are men, at 77.4%, and young adults with an average age of 27 years old. This is similar to estimates of Reddit users, estimated to be approximately 67% men and 64% of persons ages 18 to 29 years old.³⁶ Further related to gender, previous studies among college students and electronic dance music party attendees have also identified men as being more likely to have used lean in the past year than women.^{1,4,8,9} Respondents in this current study are young adults, indicative of Reddit users³¹ and the age group expected to consume lean the most.^{2,3,5} Future studies using non-convenient sampling methods are needed to provide more rigorous findings about lean use, especially the prevalence of lean use.

The purpose of this study was to learn more about the use of lean for screening, ingredient identification, and treatment purposes, not to criminalize or stigmatize substance use or SUDs.³⁷ Further, these findings are not intended to promote more restrictions on substances (eg, codeine, promethazine) used to treat medical conditions, but to inform protocols for providing support, treatment, and harm-reduction services if a SUD is present or mental health disorder symptoms are identified.

Despite study findings about lean, this study is not without limitations. One limitation is inherent to the data

collection methodology of anonymous online surveys. Persons using substance-related subReddits are not representative of all persons using lean. Although Qualtrics' ²³ bot detection (reCAPTCHA) was used, and the chances of receiving an incentive were low, there is still a risk of bots completing the survey or individuals completing the survey multiple times. Another limitation is that 3 of the 10 subReddit moderators that did not respond during the data collection period provided approval afterward and, therefore, these subReddit pages were not part of the recruitment procedures. Another study limitation is the focus on persons ages 18 and older. Future studies may also examine factors related to lean use among youths. No geographic data were captured from respondents, which may have provided context regarding lean mixtures in different regions and countries. Studies are also needed to examine the adaptability, utility, and scoring cut-offs of the LUD and LUDIT (Responses to these measures in this sample may be found in Supplemental Tables 1 and 2), both of which are unvalidated measures. Another limitation is the Cronbach alphas are lower than ideal in this exploratory study. The use of probability sampling methods in future studies about lean use is also warranted to represent the population.

Acknowledgements

Dr. Jordan Wingate, I thank you for your thoughtful edits. Hannah Neukrug, thank you for your keen eye when pilot-testing the survey. To the Moderators of Reddit, I express my immense gratitude for allowing me to post the study recruitment material. I also express my gratitude to the persons who completed this survey; without your participation, this study would be impossible.

Author Contributions

The author Orrin D. Ware confirms sole responsibility for completing all aspects of the study.

Supplemental Material

Supplemental material for this article is available online.

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