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Past-Year Kratom Use in the U.S.: Estimates From a Nationally Representative Sample

Joseph J. Palamar, PhD, MPH

Introduction: Kratom is a plant with partial opioid agonist effects, and its use has become popular to ameliorate symptoms of opioid withdrawal. However, use has been linked to thousands of poisonings, although most have involved use of other drugs. Little is known regarding prevalence and correlates of use in the general U.S. population.

Methods: Data were examined from the 2019 National Survey on Drug Use and Health, a nationally representative probability sample of non-institutionalized individuals aged ≥12 years in the U.S. (N=56,136). Prevalence and correlates of past-year kratom use were estimated. Data were analyzed in 2020.

Results: An estimated 0.7% (95% CI=0.6, 0.8) of individuals in the U.S. have used kratom in the past year. Past-year proxy diagnosis of prescription opioid use disorder was associated with increased odds for kratom use (AOR=3.20, 95% CI=1.38, 7.41), with 10.4% (95% CI=6.7, 15.9) of those with use disorder reporting use. Opioid misuse not accompanied with use disorder was not associated with kratom use. Those reporting past-year cannabis use both with (AOR=4.33, 95% CI=2.61, 7.19) and without (AOR=4.57, 95% CI=3.29, 6.35) use disorder and those reporting past-year cocaine use (AOR=1.69, 95% CI=1.06, 2.69) and prescription stimulant misuse (AOR=2.10, 95% CI=1.44, 3.05) not accompanied with use disorder were at higher odds for kratom use.

Conclusions: Kratom use is particularly prevalent among those with prescription opioid use disorder, but it is also prevalent among people who use other drugs. Research is needed to determine reasons for use and potential dangers associated with adding kratom to drug repertoires.
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INTRODUCTION

Kratom (*Mitragyna speciosa*) is a plant with psychoactive effects that has recently acquired popularity in the U.S.[1] The substance is most commonly ingested,[2] and it typically provides stimulant effects at low doses and analgesic effects at higher doses.[3] These analgesic effects occur because kratom acts as a partial opioid agonist.[4] Because of these effects, in recent years, some people have begun to use kratom as a substitute for classical opioids in an effort to ameliorate withdrawal or to self-treat opioid use disorder.[5−8] Others use kratom to self-treat depression and anxiety or to reduce pain or symptoms related to chronic conditions.[6,9]

The U.S. Drug Enforcement Administration has identified kratom as a drug of concern, and the U.S. Food and Drug Administration has issued multiple warnings about kratom, recommending individuals not to use the substance because its safety is still being evaluated.[10,11] However, kratom remains unscheduled at the federal level, and it is legal in most U.S. states, despite increasing state-level regulation. Long-term or high-frequency use can lead to dependence, tolerance, and withdrawal,[12] and major adverse effects have been reported, including agitation, seizures, central nervous system depression, and neonatal abstinence syndrome.[2,13] Adverse effects

From the Department of Population Health, New York University Grossman School of Medicine, New York, New York

Address correspondence to: Joseph J. Palamar, PhD, MPH, Department of Population Health, New York University Grossman School of Medicine, 180 Madison Avenue, Room 1752, New York NY 10016. E-mail: joseph.palamar@nyulangone.org.

associated with use have typically been mild,[3] but between 2011 and 2018, a total of 2,312 kratom exposures were reported to the National Poison Data System, with a large increase after 2015.[2] Of these exposures, 60% involved other drugs. Hundreds of deaths related to use have also occurred, with most cases involving use of other drugs. An analysis of 156 deaths involving kratom determined that 87% involved use of other drugs,[14] and another study examined 152 related deaths, of which 65% involved fentanyl use and 33% involved heroin use.[11] Although most poisonings and deaths have involved use of opioids, deaths have also involved benzodiazepines, cocaine, and psychiatric medications.[11,14] More nuanced investigation is needed to investigate kratom use in relation to use of other drugs.

Most epidemiologic research on kratom use has focused on online samples of individuals who use. Two national studies were utilized recently to estimate use,[15,16] but neither utilized probability samples, and both were conducted online and were limited to adults. This study, conducted throughout 2019, focuses on a probability sample of non-institutionalized individuals aged ≥12 years in the U.S. to estimate past-year use and correlates of use of this substance.

METHODS

Study Population
Data were examined from the National Survey on Drug Use and Health, a nationally representative cross-sectional survey of non-institutionalized individuals aged ≥12 years in the U.S. The sample was obtained through a multistage design, and surveys were administered via computer-assisted interviewing conducted by an interviewer using audio computer-assisted interviewing.[17] Analysis focused on the 2019 sample only, because this was the first year kratom use was queried. The sample size was 56,136, and the weighted interview response rate was 64.9%. This secondary analysis was exempt from review by the New York University Langone Medical Center IRB.

Measures
Participants were asked their age, sex, race/ethnicity, educational attainment, and annual family income, and experience of a major depressive episode or serious mental illness in the past year was determined through psychiatric modules.[17,18] With respect to past-year substance use, participants were asked *Whether they had used kratom, which can come in forms such as powder, pills, or leaf,* and they were also asked about use of alcohol, cannabis, cocaine, heroin, and methamphetamine and about misuse of prescription opioids, sedatives/tranquilizers, and stimulants. *Misuse* was defined as using without one's own prescription; using in larger amounts, more often, or for longer than directed; or use in any way not directed by a doctor. Those reporting past-year (mis)use of a drug were asked questions to indicate whether they met criteria for proxy diagnosis of abuse or dependence using DSM-IV[19] criteria. Those meeting criteria for either were coded as

having use disorder.[20,21] Drug use variables were coded to indicate: (1) no past-year use, (2) past-year (mis)use but not with use disorder, and (3) use disorder. Participants were also asked if they injected any drugs in the past year.

Statistical Analysis
First, prevalence of kratom use was estimated; then, demographic and drug use correlates of use were examined in a bivariable manner using Rao−Scott chi-square tests.[22] All covariates were then fit into a multivariable logistic regression model. Sample weights (provided by the National Survey on Drug Use and Health) were used to account for the complex survey design, nonresponse, selection probability, and population distribution. Data were analyzed in 2020 using Stata, version 13 SE.

RESULTS

An estimated 0.7% (95% CI=0.6, 0.8) of individuals in the U.S. have used kratom in the past year. Sample characteristics and bivariable and multivariable correlates of past-year kratom use are presented in Table 1. Compared with adolescents, individuals in adult age groups aged <50 years were at about 2−3 times the odds for use, and compared with male participants, female participants were at decreased odds for use (AOR=0.70, 95% CI=0.51, 0.97). Compared with White individuals, Black (AOR=0.27, 95% CI=0.15, 0.47) and Hispanic (AOR=0.39, 95% CI=0.26, 0.59) individuals were at lower odds for use.

With respect to drug use, past-year proxy diagnosis of prescription opioid use disorder was associated with higher odds for kratom use (AOR=3.20, 95% CI=1.38, 7.41), with 10.4% (95% CI=6.7, 15.9) of those with use disorder reporting use. Those reporting past-year cannabis use both with (AOR=4.33, 95% CI=2.61, 7.19) and without (AOR=4.57, 95% CI=3.29, 6.35) use disorder and past-year cocaine use (AOR=1.69, 95% CI=1.06, 2.69) and prescription stimulant misuse (AOR=2.10, 95% CI=1.44, 3.05) not accompanied by use disorder were at higher odds for kratom use.

DISCUSSION

This was the first study to estimate past-year kratom use from a national probability sample including adolescents. This study's estimate of past-year use of 0.7% is nearly identical to the estimate of 0.8% by another national study that did not utilize a probability sample.[15] This study adds to previous literature linking kratom use with opioid misuse,[15,16] because results suggest that, whereas those proxy diagnosed with opioid use disorder are at high odds for use, those who misuse prescription opioids but do not have use disorder are not at increased odds for use. Cannabis use and use disorder, however,

Table 1. Correlates of Past-Year Kratom Use Among Individuals Aged ≥12 Years in the U.S., 2019

Characteristics	Full sample,% (95% CI)	No kratom use,% (95% CI)	Kratom use,% (95% CI)	AOR (95% CI)
Age, years				
12–17	9.1 (8.8, 9.3)	99.7 (99.6, 99.8)	**0.3 (0.2, 0.4)*****	1.00
18–25	12.3 (12.0, 12.6)	98.7 (98.4, 98.9)	1.4 (1.1, 1.6)	**2.40 (1.41, 4.08)****
26–34	14.7 (14.2, 15.1)	98.6 (98.4, 98.9)	1.4 (1.1, 1.7)	**3.00 (1.86, 4.84)*****
35–49	22.1 (21.7, 22.6)	99.2 (99.0, 99.3)	0.8 (0.7, 1.0)	**2.55 (1.56, 4.18)*****
≥50	41.9 (41.0, 42.8)	99.7 (99.5, 99.8)	0.3 (0.2, 0.5)	1.39 (0.77, 2.52)
Sex				
Male	48.5 (47.9, 49.2)	99.1 (98.9, 99.2)	**0.9 (0.8, 1.1)****	1.00
Female	51.5 (50.8, 52.1)	99.4 (99.3, 99.5)	0.6 (0.5, 0.7)	**0.70 (0.51, 0.97)***
Race/ethnicity				
Non-Hispanic White	62.0 (61.0, 63.0)	99.1 (98.9, 99.2)	**0.9 (0.8, 1.1)*****	1.00
Non-Hispanic Black	12.1 (11.3, 12.9)	99.8 (99.6, 99.9)	0.2 (0.1, 0.4)	**0.27 (0.15, 0.47)*****
Hispanic	17.2 (16.5, 18.0)	99.6 (99.5, 99.8)	0.4 (0.2, 0.5)	**0.39 (0.26, 0.59)*****
Other/mixed	8.7 (8.2, 9.2)	99.5 (99.1, 99.7)	0.5 (0.3, 0.9)	0.67 (0.40, 1.10)
Education				
High school or less	36.3 (35.5, 37.1)	99.3 (99.1, 99.4)	**0.7 (0.6, 0.9)***	1.00
Some college	30.7 (30.0, 31.4)	99.0 (98.8, 99.2)	1.0 (0.8, 1.2)	1.05 (0.81, 1.36)
College degree	33.0 (32.2, 33.8)	99.4 (99.2, 99.5)	0.6 (0.5, 0.8)	0.83 (0.54, 1.26)
Annual family income, $				
<20,000	14.7 (14.2, 15.2)	99.1 (98.8, 99.3)	0.9 (0.7, 1.2)	1.00
20,000−49,999	28.3 (27.4, 29.1)	99.3 (99.1, 99.4)	0.7 (0.6, 0.9)	0.95 (0.64, 1.41)
50,000−74,999	15.8 (15.3, 16.3)	99.4 (99.2, 99.6)	0.6 (0.4, 0.8)	0.73 (0.42, 1.24)
≥75,000	41.2 (40.3, 42.2)	99.3 (99.2, 99.5)	0.7 (0.6, 0.8)	0.89 (0.62, 1.28)
Major depressive episode				
No	91.4 (91.0, 91.8)	99.4 (99.3, 99.5)	**0.6 (0.5, 0.7)*****	1.00
Yes	8.6 (8.3, 9.0)	98.0 (97.5, 98.4)	2.0 (1.6, 2.6)	1.28 (0.76, 2.14)
Serious mental illness				
No	94.7 (94.4, 95.0)	99.4 (99.3, 99.4)	**0.6 (0.6, 0.7)*****	1.00
Yes	5.3 (5.0, 5.6)	97.1 (96.2, 97.8)	2.9 (2.2, 3.8)	1.55 (0.87, 2.74)
Past-year other drug use				
Alcohol				
No use			**0.4 (0.2, 0.5)*****	1.00

(continued on next page)

Table 1. Correlates of Past-Year Kratom Use Among Individuals Aged ≥12 Years in the U.S., 2019 (*continued*)

Characteristics	Full sample,% (95% CI)	No kratom use,% (95% CI)	Kratom use,% (95% CI)	AOR (95% CI)
	35.0 (34.4, 35.6)	99.7 (99.5, 99.8)		
Use without disorder	59.7 (59.1, 60.3)	99.2 (99.0, 99.3)	0.8 (0.7, 1.0)	1.12 (0.70, 1.80)
Use disorder	5.3 (5.0, 5.6)	97.9 (97.3, 98.3)	2.1 (1.7, 2.7)	1.07 (0.58, 1.97)
Cannabis				
No use	82.4 (81.9, 82.9)	99.7 (99.6, 99.7)	**0.3 (0.3, 0.4)**[***]	1.00
Use without disorder	15.8 (15.4, 16.3)	97.5 (97.0, 97.9)	2.5 (2.2, 3.0)	**4.57 (3.29, 6.35)**[***]
Use disorder	1.8 (1.6, 1.9)	96.5 (95.1, 97.5)	3.5 (2.5, 4.9)	**4.33 (2.61, 7.19)**[***]
Cocaine				
No use	98.0 (97.9, 98.2)	99.4 (99.3, 99.5)	**0.6 (0.5, 0.7)**[***]	1.00
Use without disorder	1.6 (1.5, 1.8)	94.4 (92.3, 95.9)	5.6 (4.1, 7.7)	**1.69 (1.06, 2.69)**[*]
Use disorder	0.3 (0.3, 0.4)	91.4 (84.4, 95.5)	8.6 (4.5, 15.6)	1.99 (0.71, 5.56)
Methamphetamine				
No use	99.3 (99.1, 99.4)	99.3 (99.2, 99.4)	**0.7 (0.6, 0.8)**[***]	1.00
Use without disorder	0.3 (0.3, 0.4)	95.4 (89.4, 98.1)	4.6 (2.0, 10.6)	1.35 (0.43, 4.26)
Use disorder	0.4 (0.3, 0.5)	92.8 (88.2, 95.7)	7.2 (4.3, 11.8)	0.94 (0.44, 2.01)
Tranquilizers/sedatives				
No misuse	97.8 (97.6, 98.0)	99.4 (99.3, 99.5)	**0.6 (0.5, 0.7)**[***]	1.00
Misuse without disorder	2.0 (1.8, 2.2)	95.6 (93.9, 96.8)	4.5 (3.2, 6.1)	1.46 (0.92, 2.32)
Use disorder	0.3 (0.2, 0.3)	91.8 (86.3, 95.2)	8.2 (4.8, 13.7)	1.14 (0.45, 2.88)
Prescription stimulants				
No misuse	98.2 (98.0, 98.3)	99.4 (99.3, 99.5)	**0.6 (0.5, 0.7)**[***]	1.00
Misuse without disorder	1.6 (1.5, 1.7)	93.8 (91.4, 95.5)	6.2 (4.5, 8.7)	**2.10 (1.44, 3.05)**[***]
Use disorder	0.2 (0.2, 0.3)	90.6 (81.7, 95.4)	9.4 (4.6, 18.3)	2.55 (0.97, 6.72)
Prescription opioids				
No misuse	96.5 (96.2, 96.7)	99.4 (99.3, 99.5)	**0.6 (0.5, 0.7)**[***]	1.00
Misuse without disorder	3.0 (2.8, 3.3)	97.4 (96.3, 98.2)	2.6 (1.8, 3.7)	1.27 (0.83, 1.94)
Use disorder	0.5 (0.4, 0.6)	89.6 (84.1, 93.3)	10.4 (6.7, 15.9)	**3.20 (1.38, 7.41)**[**]
Heroin				
No use	99.7 (99.6, 99.8)	99.3 (99.2, 99.4)	**0.7 (0.6, 0.8)**[***]	1.00
Use without disorder	0.1 (0.1, 0.2)	94.8 (84.1, 98.4)	5.2 (1.6, 15.9)	0.67 (0.11, 4.16)
Use disorder	0.2 (0.1, 0.2)	84.0 (73.6, 90.7)	16.0 (9.3, 26.4)	1.48 (0.43, 5.07)

Table 1. Correlates of Past-Year Kratom Use Among Individuals Aged ≥12 Years in the U.S., 2019 (*continued*)

Characteristics	Full sample,% (95% CI)	No kratom use,% (95% CI)	Kratom use,% (95% CI)	AOR (95% CI)
Past-year injection drug use				
No	99.7 (99.7, 99.8)	99.3 (99.2, 99.4)	**0.7 (0.6, 0.8)**[***]	1.00
Yes	0.3 (0.2, 0.3)	89.0 (81.8, 93.6)	11.0 (6.4, 18.2)	1.48 (0.49, 4.49)

Note: Boldface indicates statistical significance.
*p<0.05, *p<0.01.
***p<0.001) regarding bivariable and multivariable models.
Education and mental illness were not assessed for adolescents, so an indicator for this age group was included in the model for each variable to retain the full sample in the multivariable model. *Major depressive episode* and *serious mental illness* refer to whether this had occurred in the past year. *Injection drug use* refers to injection of any illegal drug. Column percentages are presented in the full sample column and row percentages are presented in the columns comparing whether kratom was used.

were independently associated with increased odds for use, as were cocaine use and prescription stimulant misuse without use disorder. Although previous research suggests that most people who use kratom also use cannabis,[15,16] more research is needed to determine whether kratom is also used to alleviate symptoms associated with cannabis use disorder or disorders treated with cannabis. Research is also needed to determine whether kratom is merely another substance added to drug use repertoires.

Limitations

Some populations, such as the homeless who do not use shelters, were under-represented in this study. Therefore, prevalence of heroin use may be underestimated. The National Survey on Drug Use and Health did not ask about all forms of kratom (e.g., liquid), so use might have been under-reported. Over-reporting also could have occurred because of individuals using products mislabeled as kratom.

CONCLUSIONS

Kratom use is particularly prevalent among those with opioid use disorder, but it is also prevalent among people who use other drugs. Use has been associated with numerous adverse events, although most have involved use of other drugs. Research is needed to determine reasons for use and dangers associated with adding kratom to drug repertoires.

ACKNOWLEDGMENTS

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