



Full length article

## Prevalence and motivations for kratom use in a sample of substance users enrolled in a residential treatment program



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### ABSTRACT

**Background:** Kratom use in the West has increased recently, yet the prevalence and motives for use among individuals with a history of substance use disorder (SUD) have not been fully examined. Kratom has been documented as a means of treating chronic pain, mitigating drug dependence, and easing withdrawal symptoms, yet it is unclear if substance users are utilizing kratom as a self-medication. Abuse liability, side effects, and overall appeal of kratom remain uncertain.

**Methods:** In April 2017, an anonymous survey regarding kratom use and motivations was completed by clients enrolled in a 12-Step-oriented residential program. 500 respondents with a self-reported history of SUD completed the survey.

**Results:** 20.8% of respondents endorsed lifetime kratom use and 10.2% reported past-12-month use. Kratom-users were younger ( $= 32.1$  vs.  $35.9$ ,  $p < 0.001$ ) and were more versatile substance users. A majority (68.9%) of kratom-users reported having used the drug as a means of reducing or abstaining from non-prescription opioids (NPO) and/or heroin, and 64.1% reported using kratom as a substitute for NPO/heroin. 18.4% of kratom-users reported using the drug due to a disability or chronic pain. One-third of kratom-users stated that kratom was a helpful substance and that they would try it again. However, kratom was not preferred and was indicated as having less appeal than NPO, heroin, amphetamines, and Suboxone.

**Conclusions:** Among substance users, kratom use may be initiated for a variety of reasons, including as a novel form of harm-reduction or drug substitution, particularly in the context of dependence and withdrawal from other substances.

### 1. Introduction

*Mitragyna speciosa*, often referred to as kratom, is a botanical native to Asia that has been used for centuries for medicinal, folk, and recreational purposes, but which has recently seen increased availability and use in non-Asian countries (Brown et al., 2017; Grewal, 1932; Nelson et al., 2014). In the past decade, the use of novel alternatives to illicit drugs has proliferated, however, it remains unclear the extent to which kratom use in the West can be included among such “psycho-naut” trends (Cinosi et al., 2015; Orsolini et al., 2015; Rech et al., 2015; Warner et al., 2016). Given the limited data on kratom, it is also uncertain what the primary differences in motivations and using patterns are between kratom-users in the West and in Asia, where kratom is indigenous.

Dozens of kratom’s alkaloids have been successfully isolated and identified (Suhaimi et al., 2016), the most widely studied are

mitragynine and 7-hydroxymitragynine (for a more detailed discussion see Hassan et al., 2013; Takayama, 2004).<sup>1</sup> Kratom’s leaves can be chewed, though oftentimes it is prepared as a beverage or taken orally in powdered form (Assanangkornchai et al., 2007; Grundmann, 2017). Kratom produces variable effects depending upon strain type and dose, with some strains eliciting stimulatory effects and others producing analgesic and anxiolytic effects (Babu et al., 2008; Harun et al., 2015; Hassan et al., 2013; Hazim et al., 2014; Sabetghadam et al., 2013; Yusoff et al., 2016).

To date, no controlled experimental studies in humans exist, however, in exploratory studies, kratom has been associated with a variety of beneficial effects, including pain relief, improved mood, relaxation, pleasant somatic sensations, and increased socialization and energy (Ahmad and Aziz, 2012; Assanangkornchai et al., 2007; Grundmann, 2017; Saingam et al., 2013). Analgesic and antinociceptive properties of kratom have also been demonstrated in animal assays, though kratom’s

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<sup>1</sup> Differences in alkaloid content and potency have been documented and depend on numerous factors (León et al., 2009; Takayama et al., 1998). For instance, the age of the plant from which the leaves were sampled, the geographical region, time of year that the leaves were harvested, and the route of administration.

stimulatory effects are less well established (Apyrani et al., 2010; Carpenter et al., 2016; Matsumoto et al., 2004; Shaik Mossadeq et al., 2009; Takayama, 2004). Additionally, kratom has been associated with anxiolytic, anti-depressive, mood stabilizing, and anti-inflammatory effects in both humans (Grundmann, 2017; Swoger et al., 2015) and non-human animals (Kumarnsit et al., 2007; Yusoff et al., 2016). There are limited data regarding how kratom use may impair or enhance neurocognitive functioning in humans, though alterations in affect, attentional bias, learning, and working memory associated with kratom have found initial support in animal assays (Apyrani et al., 2010; Hazim et al., 2011; Ismail et al., 2016; Senik et al., 2012a,b; Yusoff et al., 2016). Similarly, kratom dependence symptomatology requires more exploration given that some regular users report low craving, while others express difficulty abstaining (Ahmad and Aziz, 2012; Singh et al., 2015).

Common side effects associated with kratom use in humans include constipation, dehydration, dry mouth, fatigue, increased body temperature, lethargy, weight loss, and nausea (Ahmad and Aziz, 2012; Assanangkornchai et al., 2007; Grundmann, 2017; Singh et al., 2015; Suwanlert, 1975; Swogger et al., 2015; Trakulsrichai et al., 2015). Anecdotal reports document more severe effects including hypothyroidism, seizure, coma, and hepatotoxicity (Boyer et al., 2008; Kapp et al., 2011; Nelsen et al., 2010; Sheleg and Collins, 2011). One study exploring possible thresholds for kratom toxicity in non-human animals conducted by Kamal et al. (2012) found no significant toxicity or fatalities even when large doses were administered. Similar results have been reported by Macko et al. (1972) and Sabetghadam et al. (2013), however, other animal studies provide conflicting accounts of kratom's overall effect profile, which is believed to be predicated by dose concentration, duration of use, and alkaloid type (Azizi et al., 2010; Janchawee et al., 2007).

Kratom use has been reported for managing chronic pain and for supplementing prescription drug regimens (Boyer et al., 2007; Boyer et al., 2008; Grundmann, 2017; Prozialeck et al., 2012), and as a means of mitigating drug dependence (Ahmad and Aziz, 2012; Cinosi et al., 2015; Grundmann, 2017; Low et al., 2016; Suwanlert, 1975; Ward et al., 2011). Vicknasingam et al. (2010) documented kratom use as a method of drug substitution and for easing withdrawal symptoms. Recently in the U.S., non-prescription opioid (NPO) and heroin rates have risen significantly (Kanouse and Compton, 2015; Kolodny et al., 2015; Kertesz, 2017), though the proportion of individuals using kratom due to NPO/heroin dependency is unknown.

It is also unclear how to characterize notions of kratom dependence verses kratom utility. Some regular users have reported that kratom helps to increase social, occupational, and psychological functioning (Grundmann, 2017; Singh et al., 2015), while other users have reported needing to use daily; however, broad dependence indicators, (e.g., craving withdrawal) vary (Ahmad and Aziz, 2012; Assanangkornchai et al., 2007; Saingam et al., 2013, 2016; Singh et al., 2016; Swogger et al., 2015; Vicknasingam et al., 2015). In a U.S. sample, withdrawal symptoms were reported by less than half of users (Grundmann, 2017). Evidence suggests that the length, frequency, and quantity of use may positively correlate to severity of tolerance and withdrawal in both humans and animals (Assanangkornchai et al., 2007; Matsumoto et al., 2005; McWhirter and Morris, 2010; Saingam et al., 2016; Yusoff et al., 2017) though this phenomenon has not been clearly substantiated (Havemann-Reinecke, 2011; Singh et al., 2016). Kratom has been under-researched and in the absence of controlled experimental studies, uncertainty and concern over kratom remain.<sup>2</sup>

<sup>2</sup> Such uncertainty is attributable to multiple factors, including possible variability in the content of kratom products purchased in the West compared to presumably fresher preparations in Asian countries (Griffin et al., 2016; Lydecker et al., 2016; Singh et al., 2016); variations in using patterns and motives within and across geographic regions and cultures (Vicknasingam et al., 2010); co-ingestion with other substances (Neerman et al., 2013) possible dose escalation (Vicknasingam et al., 2010), and sensationalized or

Between 2010–2015 660 kratom-related calls were made to the American Association of Poison Control Centers (AAPCC), accounting for approximately 0.0004% of all exposure calls (Anwar et al., 2016). A minority of cases (7.4%) included “life-threatening” symptoms, with severity most pronounced in instances where kratom was co-ingested with anti-depressants, mood stabilizers, anticonvulsants, and illicit drugs (Anwar et al., 2016). Reports suggesting kratom-related fatalities are few and ambiguous (Arndt et al., 2011; Holler et al., 2011; Karinen et al., 2014; Kronstrand et al., 2011; McIntyre et al., 2015; Neerman et al., 2013). Even operating under the premise that kratom was the only substance consumed prior to death, such reports demonstrate no causal connection. Multiple fatalities have also been attributed to caffeine, and there exist common instances of individuals with cardiac problems dying after consuming Aspirin tablets, yet the cause of death is not attributed to Aspirin (Banerjee et al., 2014; Lewis et al., 1983).

Finally, kratom is legal throughout much of the U.S., however, the Drug Enforcement Administration has designated it to its “Drugs and Chemicals of Concern” list and is poised to schedule kratom under the Controlled Substances Act, though the reasons for this action are unclear (Castillo, 2017; Federal Register, 2016). Although efforts to enable detection of kratom's active alkaloids are advancing, metabolites are not currently detectable by drug screens (Fuenffinger et al., 2017; Lesiak et al., 2014; Warner et al., 2016). Similar to other newer substances, kratom may be an attractive alternative for individuals who encounter drug testing (Gunderson et al., 2014; Perrone et al., 2013). Criminal justice system (CJS)-involved individuals enrolled in substance use disorder (SUD) treatment often have compelling incentives to pass drug tests (e.g., threat of parole revocation to serve the remainder of a 10-year sentence) such that they may be inclined to substitute preferred but detectable substances for undetectable alternatives (Ralphs et al., 2017). An opioid- or stimulant-dependent individual might temporarily substitute their drug regimen with kratom if they believe there is a likelihood of testing. Though opioids and stimulant drugs are metabolized and eliminated quickly, they are nevertheless still detectable on commonly used drug screens whereas kratom currently is not (Prutipanlai et al., 2017).

### 1.1. Purpose of study

Kratom use is likely being initiated for multiple reasons, including the management of health conditions, mitigation of drug dependence, and for recreation (Ahmad and Aziz, 2012; Assanangkornchai et al., 2007; Grundmann, 2017). However, few data are available describing the prevalence and motives for kratom use among individuals with SUD. The aim of this study was to determine the prevalence and motivations for kratom use in a sample of individuals receiving SUD treatment. Additional aims included identifying routes of administration, methods for obtainment, and indicators of adverse effects. Given the uncertainty surrounding kratom's abuse liability and perceived salience, an ancillary aim was to determine if users preferred kratom to other substances.

## 2. Methods

### 2.1. Study participants and data collection

Clients in five recovery centers operating under a 12-step, residential therapeutic-community model were purposefully sampled for inclusion. All data were collected in April 2017. The recovery centers are part of a network of 17 community-based residential recovery programs open to individuals with SUD. A convenience sample was obtained by meeting with clients during program hours. Clients were

(footnote continued)  
inaccurate media coverage (Miller et al., 2015).

notified that study participation posed minimal risk and would not impact their standing in the program or with the Department of Corrections. Clients were not compensated for their participation. This study was approved by the University of Louisville's Institutional Review Board (IRB No. 17.0285).

### 2.1.1. Survey instrument and administration

An anonymous, self-administered 49-question paper survey was provided to clients. Those who declined to participate worked on recovery-related materials. Survey questions included items related to demographic information (e.g., age, employment history), health information (e.g., past 12-month emergency department (ED) utilization), and lifetime and past-12-month substance use. Clients were also asked to list the three substances they had most preferred using prior to treatment.

Kratom has generally been available in the U.S. since 2010. Thus, many survey questions pertained to the past 7-year period, (e.g., "Have you been on probation or parole at any time since 2010?"). This was done in order to ascertain the portion of time clients spent in a controlled environment or under surveillance where drug testing is routine during the period in which they would have been most likely to encounter kratom. Clients were also asked questions pertaining to the past-12-month period prior to treatment (e.g., "How many months have you been in any treatment or recovery center in the past 12 months?"). Finally, clients were asked to respond to specific statements about kratom (see Table 4).

### 2.2. Data analysis

Data were analyzed using IBM SPSS-24. Descriptive statistics were examined for all relevant variables in order to establish prevalence for kratom use and motives for use. Chi-square goodness-of-fit was used to analyze nominal and ordinal variables and *t*-test was used to analyze ratio-level variables in order to determine statistically significant differences between kratom-users and non-users.

## 3. Results

### 3.1. Demographics

The final sample (N = 500) included men (58.4%) and women (41.6%) age 18–64 ( $\bar{x}$  = 35.1) with a history of SUD enrolled in treatment. The majority of clients (53.6%) resided in two high-urban centers, followed by two moderate-urban centers (29.4%), and one rural center (17.0%). The average length of time in the program was 3.5 months. 67.8% had previously been in treatment. Table 1 displays sample characteristics and between-group differences.

Of the total number of clients surveyed, 20.8% (N = 104) reported lifetime kratom use and 10.2% (N = 51) reported past-12-month use. Kratom-users were younger, ( $\bar{x}$  = 32.1 vs. 35.9,  $p < 0.001$ ), were predominantly single (35.9% vs. 45.6%,  $p = 0.050$ ), and more likely have a college degree (23.5% vs. 11.8%,  $p = 0.002$ ). Most clients indicated past-12-month housing instability (see Table 1.), however, homelessness was higher among kratom-users (9.6% vs. 4.4%,  $p = 0.031$ ). Kratom-users reported a more extensive treatment history (82.7% vs. 63.9%,  $p < 0.001$ ), greater number of lifetime treatment episodes ( $\bar{x}$  = 4.4 vs. 3.3,  $p = 0.026$ ), and greater past-year number of months spent in a separate treatment program ( $\bar{x}$  = 1.8 vs. 1.2,  $p < 0.031$ ).

Fewer kratom-users were on probation/parole (69.4% vs. 83.2%,  $p < 0.005$ ). Groups were similar for prior incarceration rates and number of years incarcerated, though kratom-users reported more separate incarceration instances ( $\bar{x}$  = 6.9 vs. 5.4  $p = 0.013$ ). Rates for failed drug tests did not differ between groups. The majority of individuals reported past-year ED utilization, however, kratom-users reported higher rates of any ED use ( $p = 0.007$ ) as well as higher ED rates

**Table 1**  
Descriptive, *t*-test and chi-square goodness-of-fit results for demographics, criminal justice, and treatment variables for entire sample, kratom-users, and non-users.

	All N = 500	Kratom users N = 104 20.8%	Non-users N = 396 79.2%	p value
Age ( $\bar{x}$ )	35.1	32.1	35.9	0.001
Male	58.4	60.6	57.8	0.613
White	84.1	88.3	83.0	0.186
Marital Status				
Single	48.7	51.5	47.9	0.050
Divorced/Widowed	7.7	12.6	6.4	
Married/committed partnership	43.6	35.9	45.6	
Education				
No High School Diploma/GED	8.5	2.0	10.2	0.002
High School Diploma/GED only	51.3	46.1	52.7	
Some college	26.0	28.4	25.3	
Associates degree or higher	14.2	23.5	11.8	
Employment Status				
Full-time/part-time	47.0	44.2	47.8	0.610
Unemployed	22.0	26.0	20.9	
Incarcerated	25.5	23.1	26.1	
Disabled, student, retired	5.5	6.7	5.2	
Experienced homelessness past 12-months	17.0	24.0	15.1	0.031
Primary living situation				
Living alone or with partner/roommate	33.2	29.8	34.1	0.213
Staying with friends/family	22.3	24.0	21.8	
Halfway house/recovery center	13.0	14.4	12.6	
Incarcerated	26.1	22.1	27.2	
Homeless	5.5	9.6	4.4	
Prior substance use treatment	67.8	82.7	63.9	0.001
Number of prior substance use interventions ( $\bar{x}$ )	3.5	4.4	3.3	0.026
Number of months in other treatment program ( $\bar{x}$ )	1.32	1.8	1.2	0.031
Past 12-month emergency room (ER) utilization	64.2	75.5	61.2	0.007
Drug-related	42.9	61.0	38.3	0.001
Mental health-related	23.0	41.0	19.3	0.003
Physical health-related	55.0	68.0	52.0	0.009
Incarcerated past 7 years	88.0	91.3	87.1	0.232
Separate incarceration instances	5.7	6.9	5.4	0.013
Years incarcerated ( $\bar{x}$ )	1.8	1.84	1.78	0.709
Arrested past 12-months	70.2	75.2	68.9	0.214
Months incarcerated past 12 months ( $\bar{x}$ )	4.2	3.7	4.3	0.110
Probation/parole past 7 years	73.7	77.0	73.0	0.446
Probation/parole number of years ( $\bar{x}$ )	2.8	2.9	2.7	0.495
Currently on probation/parole	80.0	69.4	83.2	0.005
Probation/parole months ( $\bar{x}$ )	6.8	6.5	7.0	0.358
Chronic pain	40.0	37.9	39.9	0.700
Considers themselves disabled	15.0	12.7	15.6	0.466
SSDI	6.9	5.8	7.2	0.630
Medical insurance, Medicaid, Medicare	87.8	86.3	88.2	0.596

for drug-related (61.0% vs. 38.3%,  $p < 0.001$ ), mental health-related (41.0% vs. 19.3%,  $p = 0.003$ ), and physical health-related problems (68.0% vs. 52%,  $p = 0.009$ ). Groups were similar for rates of chronic pain, self-perceived disability, and Social Security Disability Insurance or medical insurance.

**Table 2**

Chi-square proportions and significant differences for substance use for entire sample, kratom-users, and non-users.

	All N = 500	Kratom users N = 104 20.8%	Non-users N = 396 79.2%	p value
<b>Lifetime substance use</b>				
Cigarettes	97.0	100.0	96.2	0.131
E-cigarettes	83.8	96.2	80.5	0.001
Alcohol	99.0	99.0	99.0	0.963
Marijuana	98.6	99.0	98.5	0.669
Synthetic Marijuana	68.5	88.5	63.3	0.001
Non-prescription opioids	86.8	99.0	83.5	0.001
Non-prescription Suboxone	78.2	98.1	72.9	0.001
Heroin	73.3	95.2	67.6	0.001
Cocaine	92.6	98.1	91.1	0.016
Crack	79.6	86.5	77.8	0.048
Amphetamines	86.2	99.0	82.8	0.001
Synthetic Cathinones	28.3	47.1	23.3	0.001
Sedatives	88.2	99.0	85.3	0.001
Barbiturates	36.7	55.8	31.6	0.001
Inhalants	33.3	46.2	29.9	0.002
Club Drugs	60.7	83.7	54.7	0.001
Hallucinogens	67.9	87.5	62.8	0.001
<b>Past 12-month substance use</b>				
Cigarettes	87.8	92.2	86.6	0.119
E-cigarettes	65.2	78.6	61.7	0.001
Alcohol	75.3	82.5	73.4	0.055
Marijuana	65.4	77.7	62.2	0.003
Synthetic Marijuana	23.7	35.9	20.6	0.001
Non-prescription opioids	62.8	79.6	58.4	0.001
Non-prescription Suboxone	51.5	74.8	45.4	0.001
Heroin	55.6	85.4	47.8	0.001
Cocaine	43.8	57.3	40.6	0.002
Crack	34.6	44.7	32.2	0.018
Amphetamines	65.5	85.4	60.3	0.001
Synthetic Cathinones	6.6	12.6	5.1	0.006
Sedatives	45.5	56.3	42.6	0.013
Barbiturates	8.9	12.6	7.9	0.131
Inhalants	5.0	9.7	3.8	0.014
Club Drugs	13.3	24.3	10.4	0.001
Hallucinogens	13.1	23.3	10.4	0.001
<b>Drug of choice</b>				
First: Heroin	33.7	60.7	45.5	0.003
Second: Amphetamines	19.3	29.8	27.7	
Third: Alcohol	15.4	9.5	26.9	
<b>Second Drug of Choice</b>				
First: Amphetamines	23.4	52.2	44.0	0.019
Second: Non-prescription opioids	15.7	17.9	36.0	
Third: Heroin	11.5	29.9	20.0	
<b>Third Drug of Choice</b>				
First: Amphetamines	14.6	26.2	37.2	0.378
Second: Marijuana	14.1	35.7	33.1	
Third: Non-prescription opioids	13.2	38.1	29.7	
Age of alcohol use initiation	12.48	12.49	12.47	0.977
Age of illicit drug use initiation	14.21	13.67	14.35	0.180
Has violated probation/parole for failing a drug test	55.6	55.7	55.6	0.988

### 3.2. Drug history and preferences

Kratom-users reported a more extensive substance use history (see Table 2), in that they were more likely to have tried infrequently used substances such as inhalants (46.2% vs. 30.0%,  $p < 0.001$ ), barbiturates (55.8% vs. 31.6%,  $p < 0.001$ ), synthetic cathinones (47.1% vs. 23.3%,  $p < 0.001$ ), and hallucinogens (87.5% vs. 62.8%,  $p < 0.001$ ). Beyond this, significant ( $p < 0.001$ ) between-group differences in drug use occurred for heroin, NPO (e.g., Vicodin), sedatives (e.g., Xanax), and amphetamines, though these drugs showed high favorability across the sample. (See Table 3). Kratom-users showed greater

**Table 3**

Frequencies of drug preferences between kratom-users (N = 500).

	Kratom-users (20.8%)	Non-users (79.2%)
<b>Most preferred substance</b>		
Alcohol	7.8%	17.4%
Marijuana	0.0%	7.7%
NPO	6.8%	10.5%
Suboxone	4.9%	2.8%
Heroin	49.5%	29.5%
Cocaine	1.0%	3.6%
Crack	0.0%	5.6%
Amphetamine	24.3%	17.9%
Sedatives	1.9%	1.3%
Bath Salts	2.9%	0.5%
<b>Second most preferred</b>		
Alcohol	3.9%	10.9%
Marijuana	3.9%	13.0%
NPO	11.7%	16.8%
Suboxone	1.9%	4.5%
Heroin	19.4%	9.3%
Cocaine	7.8%	6.9%
Crack	6.8%	5.9%
Amphetamine	34.0%	20.5%
Sedatives	5.8%	7.2%
Club drugs	1.9%	1.3%
<b>Third most preferred</b>		
Alcohol	9.8%	13.7%
Marijuana	14.7%	14.0%
NPO	15.7%	12.5%
Suboxone	7.8%	4.7%
Heroin	3.9%	5.8%
Cocaine	5.9%	6.4%
Crack	3.9%	8.4%
Amphetamine	10.8%	15.7%
Sedatives	16.7%	11.9%
Cigarettes	2.0%	2.3%

preference for heroin and amphetamines and less preference for alcohol and marijuana. Kratom was not indicated as a preferred substance. Of the entire sample, 78.2% endorsed having ever used non-prescription Suboxone and 51.5% reported past-12-month use. Although kratom's pharmacokinetic profile is unique, non-prescribed Suboxone may be the most conceptually similar substance to kratom (*vis à vis* as an opioid replacement) that respondents could endorse. Kratom-users had higher lifetime (98.1% vs. 72.9%,  $p < 0.001$ ) and past-12-month rates (74.8% vs. 45.4%) for non-prescribed Suboxone use and indicated greater preference to Suboxone (4.9% of vs. 2.8%).

### 3.3. Methods of obtainment and use

Over a quarter of kratom-users reported that kratom was less expensive than NPO/heroin (27.2%). Many users purchased kratom at "head" shops (i.e., drug paraphernalia stores) (62.5%), convenient stores (25.0%), or online (20.2%) or obtained it from a friend (44.2%). Swallowing kratom (75.0%) or preparing it as a tea/beverage (55.8%) were the most common routes of administration.

### 3.4. Motivations for kratom use and effects

A majority (68.9%) of kratom-users reported that they used kratom as a means of reducing or stopping NPO/heroin use and 64.1% used kratom to substitute NPO/heroin. 18.4% of users reported using kratom due to a disability or to reduce chronic pain. Nearly half of kratom-users endorsed curiosity as a reason for use (42.7%) and equally many reported using it to by-pass drug tests. Approximately half of users reported legality as a motivator and one-third reported that kratom was easier to obtain than NPO/heroin. 9.7% preferred the effects of kratom compared to effects produced by NPO/heroin. Only 1.0% reported seeking medical attention because of kratom. Approximately 8%



**Table 4**  
Descriptive statistics for prevalence, motives, and methods of kratom use.

Have you ever used kratom in your lifetime?	20.8% (N = 104)
Kratom past 12-month use	10.2% (N = 51)
Has used kratom to try to “cut back on or get off of heroin, opiates, prescription painkillers”.	68.9
Used kratom as a way to reduce or stop using opiates or heroin.	60.2
Kratom was less expensive than opiates or heroin.	27.2
Used kratom as a substitute for opiates or heroin.	64.1
Preferred the kratom highs to those of opiates or heroin.	9.7
Kratom was easier to obtain than opiates or heroin.	35.0
Used kratom because it is legal to purchase in the state.	55.3
There were fewer unpleasant side effects from kratom than from opiates or heroin.	27.2
Used kratom due to a disability or to reduce chronic pain.	18.4
Tried kratom because you were curious about the effects.	42.7
Tried kratom because your friends were using it.	35.9
Used kratom to avoid failing a drug test.	42.7
Felt ‘hangover’ the after using kratom.	7.8
Often felt jittery or anxious when using kratom.	8.7
Sought medical care because of the effects of kratom.	1.0
Would try kratom again.	33.0
Think kratom is a helpful drug.	31.1
Route of administration	
Injected	1.0
Snorted	10.6
Smoked	4.8
Swallowed	75.0
Made into tea or beverage	55.8
Method of obtainment	
Friend	44.2
Gas station or convenience store	25.0
Internet	20.2
Stranger	3.8
Family member	6.7
Head shop or smoke shop	62.5
Drug dealer	5.8

reported feeling “hangover” and 8.7% reported feeling “anxious or jittery” after consuming kratom. Just over a quarter of users (27.2%) reported that kratom produced fewer unpleasant side effects than NPO/heroin. Lastly, approximately one-third of kratom-users stated that they would try kratom again and that they believe it is a helpful drug.

#### 4. Discussion

This exploratory study is the first in the U.S. to document the prevalence and motives for kratom use among a sample of substance users enrolled in treatment. This study’s findings considered with those of Grundmann (2017) indicate that individuals in U.S. are motivated to use kratom for a variety of reasons, some of which are similar to those observed in Asian-based studies, including as an alternative for addressing drug dependence and chronic pain, for reducing anxiety, and to improve well-being (Vicknasingam et al., 2010; Singh et al., 2016). Increasing occupational stamina is one reason for kratom use reported in Asian-based studies (Saingam et al., 2014), but there are no indications that this is the case for U.S. consumers.<sup>3</sup> Whatever differences in motives for kratom use between geographic regions is eventually established, it may be that some variance is attributable to sociocultural factors, considering the long history of kratom cultivation and use that is absent in the U.S., a nation where overall greater drug use versatility is observed (Degenhardt et al., 2008; Saingam et al., 2014).

These findings indicating preference for other substances and kratom’s putative utility, it is unlikely that the majority of these users are

consuming kratom primarily for achieving recreational “highs”. Similarities in kratom’s effects (e.g., analgesic, increased sociability) have been documented, though how effects differ among individuals and geographic regions remains unclear. Differences in kratom’s observed effects between regions may be due to differences in routes of administration (e.g., chewing leaves, swallowing in powdered form) or in the potency of products available in the U.S. versus countries where kratom is indigenous. Ultimately, it may be that motivations for use and dependence indicators differ as much among individuals within the same geographic region and sociocultural structure than they do between regions. For instance, the instinct to improve one’s well-being and functioning is universal, however, concerns about drug testing or detoxing from heroin are not. Nuanced investigation into the motivations among individuals and groups within regions will likely show a heterogeneity of kratom-users similar to that observed among licit and illicit marijuana users (Cerdá et al., 2012).

Individuals in this sample had many shared attributes, however, those with greatest drug versatility endorsed kratom use more often. Such versatility is indicated by the overall greater number of substances used, the number of prior interventions, and the higher rates of past-12-month ED utilization for drug-related problems. Indiscriminant using may partially express a general proclivity to at least try new alternative substances (i.e., sensation-seeking, or peer-group influence), even if routine use is not adopted. Since the amount of kratom consumed and the duration of use was not quantified, this study cannot sufficiently parse “kratom-user” from “polysubstance user”. However, that one-third of kratom-users stated that they would try kratom again and believe it to be a helpful drug suggests that there exists a subgroup of kratom-users proper.

Given the growth of the online kratom industry over the past five years, lower than expected rates (20.2%) for online purchasing of kratom were observed. This may be attributable to housing instability and economic marginalization among this group, since credit/debit cards and a stable address are needed for online purchases. That kratom is not detectable by standard drug tests puts it on par with synthetic drugs which have been indicated as being used for circumventing detection (Bonar et al., 2014; Gunderson et al., 2014; Vandrey et al., 2012). It is uncertain as to whether this was a primary or secondary driver of use. For instance, the same number of individuals who endorsed drug-testing (42.7%) also endorsed curiosity. The percentage of individuals using kratom due to chronic pain/disability (18.4%) was lower than that observed in non-clinical samples (Grundmann, 2017) and lower than anticipated, given higher rates of disability and self-medication among CJS-individuals (Bronson et al., 2015; Hall et al., 2016). It could be that these users do not regard kratom as “medicinal” or that kratom has not yet become broadly publicized as conceptually analogous to medical marijuana (Compton et al., 2017).

Many kratom-users reported past 12-month ED utilization for drug-related problems, however, only 1.0% reported seeking medical care specifically due to kratom. This may indicate that, compared to other substances, kratom is more benign. Grundmann (2017) observed similarly low rates (0.065%) of kratom-related medical care, which is consistent with findings from Asian-based studies (Ahmad and Aziz, 2012). Few users indicated that kratom produced anxiety or “hangover” effects. Elsewhere, kratom has been used specifically for the purposes of reducing affective dysregulation (Grundmann, 2017).

Polysubstance use among kratom-users in this sample is still noteworthy given kratom’s complex, not fully understood, pharmacokinetics (Suhaimi et al., 2016; Srichana et al., 2015), the variability in the composition of kratom products (Lydecker et al., 2016), and prior reports documenting adverse effects from co-ingestion (Nelsen et al., 2010; Sabetghadam et al., 2013).<sup>4</sup> However, this concern may be less a

<sup>3</sup> While this study did not explicitly ask individuals if they used kratom to enhance occupational functioning, it is possible that a reduction in withdrawal or pain symptoms did facilitate occupational participation for some.

<sup>4</sup> In their study of regular kratom-users, Singh et al. (2016) noted that some individuals preferred to add dextromethorphan or Ermin 5 to their kratom beverages as a potentiator.

matter of co-ingestion of kratom with other substances specifically as it is as a matter of a co-ingestion of multiple substances generally.

#### 4.1. *Kratom: method for harm-reduction, drug of abuse, or both?*

Kratom has been used to mitigate licit and illicit drug dependence, ease opioid withdrawal, serve as a drug substitution, and address chronic pain (Boyer et al., 2008; Grundmann, 2017; McWhirter and Morris, 2010; Vicknasingam et al., 2010). Such utility-based using patterns are supported by several findings in this study. Indeed, reports describing kratom use to ease dependence and withdrawal from other substances and to abstain from addictive drugs dates back decades (Burkill, 1935; Boyer et al., 2007; Havemann-Reinecke, 2011; Prozialeck et al., 2012; Ward et al., 2011). A majority of users in this study reported using kratom as means of reducing or halting NPO/heroin use, yet a minority (9.7%) reported that they preferred kratom's effects compared those produced by NPO/heroin. Similarly, kratom-users preferred Suboxone to kratom. It is important to consider potential differences in respondents' interpretation of the drug preference question when asked to list their top 3 "drugs of choice" in the order they most preferred using them. Responding to this, individuals could have conceptualized "preference" not merely in terms of pleasurable effects, but also by attributes such as utility (e.g., Suboxone as a means of reducing NPO/heroin use). Although Suboxone was less popular compared with other substances, kratom was only listed as a third most preferred substance and only by 3 individuals. It is also important to consider the idea that stimulant-dependent individuals may be using kratom as a drug substitute, to ease dependence and withdrawal, or as a harm-reduction method, considering that certain strains of kratom produce stimulatory effects (Ahmad and Aziz, 2012). This idea is reinforced by Asian-based studies in which individuals use kratom to increase stamina and energy (Assanangkornchai et al., 2007; Saingam et al., 2014; Suwanlert, 1975).

Evidence suggests that kratom is an opioid-receptor agonist with complex mechanisms of action and there is speculation that kratom may be more potent than opioids such as morphine (Matsumoto et al., 2004). There is also evidence suggesting that opioid-dependent individuals will substitute one drug type for another when psychoactive effects are comparable (e.g., prescription painkillers and heroin) or when there is perceived benefit (e.g., Suboxone, methadone maintenance treatment [MMT]) (Cicero et al., 2014; Farrell et al., 1994; Mendelson et al., 2008). Yet, of the minority of respondents who had tried kratom, less than 10% indicated that they preferred kratom compared to NPO/heroin, indicating that either kratom does not produce effects comparable to opioid drugs with high abuse potential or that a steep dose escalation is required (Vicknasingam et al., 2010) in order for comparable effects comparable to be achieved—perhaps making kratom more appealing for purposes of easing withdrawal than for recreation. Drug-using individuals share information informally (Rönkä and Katainen, 2017). It is unlikely that any relatively inexpensive, predominantly legal opioid-agonist comparable to morphine could be available without rapid, widespread adoption among opioid users. Further, it could be that the typically oral route of kratom self-administration, compared to intravenous use, is simply less salient for this population. There was a significant decrease between lifetime rates of kratom use compared to past 12-month use. This inconsistency or decrease may again indicate that kratom is either not as pleasurable or potent as illicit substances or that using motivations were transient.

Taken together these findings counter the notion that kratom is equally appealing and potent as other substances. For instance, when data were collected, kratom was legal in Kentucky and all but six states,

(footnote continued)

There are also recent reports of youth in Thailand consuming kratom-containing beverages mixed with harmful adulterants (Likhitsathian et al., 2015; Tungtanuwat and Lawanprasert, 2010).

was easily procurable, and relatively inexpensive, yet it was not preferred to illicit drugs that entail greater risk with procurement and use. This is not to suggest that kratom dependence is unthinkable among individuals who switch from NPO/heroin to kratom, or that among populations without a SUD an individual would not eventually become dependent on kratom (or another opioid substitute) (Van Hout et al., 2017; Waljee et al., 2017). Indeed, Singh et al. (2016) documented individuals who used kratom to successfully abstain from other substances only to become dependent on kratom. However, individuals in this same study also reported that kratom had a high utility function, including continued abstinence from other drugs. Caffeine and cocaine are both abusable substances which can result in dependence, however the differences in utility function and consequences between the two substances are substantial.

As is the case with any substance use, the unique cognitive, affective, and behavioral attributes, capacities, and intentions of the individual as he exists dynamically within his proximate and distal cultural milieu are significant contributors to whether or not drug dependence is achieved, even as there remains a generic neurobiological potential for abuse and dependency (Bandura, 2001; Sharkey et al., 2015; Hassan et al., 2013; Heyman, 2009; Müller and Schumann, 2011). The opportunity to choose what substance one consumes likely plays a role, given that drug-using populations have been observed to use less preferred substances in controlled environments which they would not use at equal rates in unrestricted conditions (Baker, 2015; Ralphs et al., 2017). Lastly, drug-dependent individuals are a heterogeneous population and are not without some degree of agentic functioning, however constrained it may be by habituated and compulsive states of active, heavy use (Bandura, 1997, 1999; Everitt and Robbins, 2016; Heyman, 2009; Baumeister et al., 2010; Volkow et al., 2016).

It is recognized that SUD is a multidimensional phenomenon that does not exist in a vacuum (Heilig et al., 2016) and that self-efficacy as a driver of human agency (albeit constrained) can inform goal-directed action, including a reduction in the amount of substance consumed or the substitution of low-utility, highly-detrimental substances for alternatives which facilitate comparatively greater adaptive functioning (Farrell et al., 1994; Mendelson et al., 2008). The finding that the majority of kratom-users in this sample used kratom as a means of reducing or abstaining from NPO/heroin indicates that even when choosing to conceptualize these particular kratom-users as more versatile or impulsive drug consumers, there is nevertheless indication of planned action insofar as individuals had identifiable outcome expectancies that by using kratom they could expect enhanced ability to modify NPO/heroin use. Such reasoning could be extended to all of the self-reported motivations for kratom use entailing clear commission. For those who used kratom to mitigate drug dependence and/or address chronic pain, applicable factors of availability, price, and curiosity likely facilitated utility-based using, but were not the primary motivators in and of themselves.

When compared with previous findings (Swogger et al., 2015; Grundmann, 2017), these data suggest inconsistency in how kratom is conceptualized and used by different populations. These findings should be understood in the context of a sample enrolled in a 12-Step recovery environment, as opposed to other substance-using, clinical populations who may be receiving individualized, evidence-based interventions (verses strong abstinence-only programming). For example, some participants may have been primed to respond 'no' to statements such as "Kratom is a helpful drug" or "I would try kratom again".

Ultimately, understanding kratom's effects, along with the drivers responsible for meaningful variance among kratom-users, requires an investigatory scope that surpasses this study. Kratom's role in aiding detoxification remains unclear, but is likely that kratom-users in this sample utilized kratom to detox from other substances (Boyer et al., 2008; Vicknasingam et al., 2010). The results of this small, exploratory study, considered alongside previous findings of (Grundmann, 2017; Swogger et al., 2015) indicate that there are clear motivations for using

kratom, including goal-directed utility. Kratom's efficacy as a self-adopted harm-reduction method for NPO/heroin dependence, especially compared to medicalized alternatives (e.g., Suboxone, MMT), its appeal to substance users as a surrogate for preferred drugs, and its ability to satisfactorily address the needs of individuals with chronic pain remain equivocal, but are promising avenues of research.

#### 4.2. Limitations

There are several limitations to this preliminary study. The term "kratom" was used broadly. As noted elsewhere, such conceptualization is problematic for research purposes (Fluyau and Revadigar, 2017). Insufficient user knowledge and possible variability between brands and strains across regions makes establishing the profile of kratom as a comprehensive entity challenging (Oliveira et al., 2016). Future work should capture the degree of discrimination that users demonstrate when selecting kratom strains and the differences in effects. Other limitations include the fact that while it can be reasonably speculated that kratom was used by individuals to facilitate drug detoxification, this phenomenon was not quantified. Individuals using kratom to aid in detoxification or as a means of harm-reduction should be examined as a distinct subpopulation with kratom's effects more directly compared to those of Suboxone and methadone. This study failed to establish kratom's efficacy as a means of harm-reduction or as a form pain management which would have significantly aided in clarifying using trajectory. This study also was unable to capture whether or not kratom was routinely co-ingested with other substances, and it may be that these kratom-users are better be characterized as versatile substance users who merely endorsed casual kratom use. This ambiguity extends to interpretation of drug-related ED utilization. More studies spanning geographic regions are needed to determine the effects of kratom when used independently and concomitantly. Lastly, self-report methodology includes the possibility of inadequate recall and mendacity, however, among drug-using samples, it is accepted as valid and reliable data collection method (Darke, 1998; Denis et al., 2012; Zanis et al., 1994).

#### 5. Conclusion

Prevalence and motivations for kratom use was established among a sample of individuals enrolled in SUD treatment. Kratom use appeared among more versatile users and was associated less with pleasure or preference and more with curiosity and utility. Kratom's expressed utility as a form of harm-reduction coupled with the lack of preference for kratom compared to other substances suggests that kratom may be a novel form of harm-reduction with a lower abuse potential. Experimental studies documenting kratom's effects in humans and non-human animals should be developed so that a cogent pharmacokinetic profile can be established and used to infer the probability of kratom's abuse in real-world settings where other drugs are ubiquitous. Kratom's eventual development as an opioid-replacement is partially bolstered by preliminary data suggesting kratom's potential pharmacological benefit with comparatively fewer adverse effects than observed in prescription opioids (Khor et al., 2011; Matsumoto et al., 2005; Matsumoto et al., 2008; Trakulsrichai et al., 2015). Kratom's utility as a means of mitigating NPO/heroin dependence requires further investigation, but appears promising. Given the increasing rates of NPO/heroin overdose and mortalities in the U.S. (Rudd et al., 2016) and the cost of addressing this public health epidemic, it is important that additional methods for harm-reduction beyond Suboxone and MMT be considered (Connock et al., 2007; Kandel et al., 2017; Mattick et al., 2008).

#### Author disclosures

##### Contributors

TL is the principal investigator and KS is the co-investigator of the study from which the data for this paper originated. KS authored the contents of this paper and conducted statistical analyses. Additional editorial suggestions were provided by TL. All authors approved of the manuscript before submission.

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##### Conflict of interest

Nothing declared.

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