# ORIGINAL CONTRIBUTION

# Cannabis Use Patterns and Related Health Outcomes Among Spanish Speakers in the United States and Internationally

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Cannabis and health research continue to largely ignore the usage patterns, perceptions, and medically related use in Spanish-speaking communities. The primary aim of this study was to collect data among Spanish-speaking communities on cannabis use that specifically characterizes granular demographic information, medically motivated and recreational use patterns including potency of products, medical motivations for use, and what perceptions are held as to risks and benefits. Secondarily, exploratory analyses were made to investigate potential effects of location or acculturation status. Five hundred forty-nine individuals completed the survey, including 294 residing in the United States (US) ($M_{age}$=31.8, $SD$=9.72; 154 women, 137 men, 3 non-binary and self-described individuals), 174 residing outside of the US (International) ($M_{age}$=26.6, $SD$=8.75; 77 women, 96 men, 1 non-binary and self-described individuals), and 81 who did not report country of residence (Unknown location) ($M_{age}$=26.7, $SD$=7.37; 17 women, 61 men, 3 non-binary and self-described individuals). Overall use was mostly recreational, while the US group was significantly more motivated by medical or combined medical and recreational reasons than the other two groups ($p$=0.02). The most common reason for medical use was anxiety or depression (14% of sample). The US group also smoked or vaporized significantly more often than the other two groups and was more likely to include daily users ($p$<0.001). The sample generally viewed the effects of cannabis use more favorably than negatively, but there were significant differences in these views between users and non-users. The rich heterogeneity suggested by these data belies the importance of taking an equity focused approach to cannabis research and will help to improve representation in the field.

## INTRODUCTION

Cannabis has been used throughout history as an alternative medicine [1-3], including within the Mexican folk tradition of *curanderismo* [4,5] or as part of the US Pharmacopeia [6,7]. However, cannabis was banned from non-medical use in 1937 [8] and later listed as a Schedule I drug in 1971 [9], resulting in the incarceration of millions of people over the ensuing decades.

Despite the fact that nine in 10 Americans support some form of legalization [10], 40% of all drug-related

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offenses in the US in 2018 were cannabis-related [11]. While cannabis-related arrests declined by more than 35% in 2019, more people were arrested for cannabis in the US that year than for all violent crimes combined [12]. This enforcement has disproportionately targeted communities of color [8,13-18]. For example, there is evidence of systematic profiling and deportation of Hispanic[1] community members [15,18], and other evidence that "intensity of enforcement" is significantly related to income level and race [19]. Importantly, these inequities persist despite that Black and Hispanic Americans use cannabis at roughly the same rate as Whites [20].

The legal status of cannabis use beyond the US is also rapidly shifting. Similarly to US law, the United Nations considers cannabis a Schedule I drug according to the Single Convention on Narcotic Drugs [21], the 1971 Convention on Psychotropic Substances [22], and the 1988 Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances [23]. However, much like individual states in the US, individual countries have proceeded to develop their own laws and regulations pertaining to cannabis.

Legal approaches generally include legalization, decriminalization, and enforced prohibition. South American countries have largely decriminalized cannabis use, with the exceptions of Venezuela, Guyana, Suriname, and French Guiana. This is in contrast to most of Africa, Asia, Europe, and Australia where cannabis is largely illegal. Among countries for which the national language is Spanish, Argentina, Chile, Columbia, Ecuador, and Peru have all legalized medical cannabis use to varying degrees [24,25]. In Uruguay, where both recreational and medical cannabis use is legal, medical cannabis use is more favorably viewed than recreational use [26]. However, there is evidence to suggest there is a great deal of heterogeneity in opinions on legalization across Central and South America [27].

Biomedical research on cannabis has expanded [28]. While much of the work originated in the United States and Canada, other countries such as Israel continue to make an increasing contribution to the literature [29]. Argentina was home to the first clinical research protocol on cannabis in South America in 2018 [24], and much of the medical cannabis legislation on the continent has been driven by patient and parent advocates [30-32]. Unfortunately, most of the cannabis and health research globally has been conducted among mostly White, male, English speakers, and demographics are inconsistently reported [33,34]. Given that there is evidence that cannabis has

both beneficial properties [35] and potential for harm [36,37], it is important from a public health perspective to understand motivations for and perceptions of use for diverse groups worldwide, and not just for a small portion of the English-speaking population.

### Survey-based Literature on Real-world Cannabis Use Patterns and Health Outcomes

While there is broad research on substance use based on large national surveys in the US, there is comparatively little survey-based research that examines specific cannabis-use patterns, potencies, and medically motivated use and perceptions. The National Health Interview Survey (NHIS) suggested in 2007 that 38% of adults use some form of alternative medicine [38], but there was little granular detail parsing different types of substances, how they were used, or for what purposes. Another more recent US national survey suggested that cannabis use incidence rates are between 11 and 25% for "legal" states and 7 and 17% for "illegal" states, but there is no current data that estimates incidence of medically-motivated use. Some grey literature broadly estimates between 2 and 5 million medical cannabis users nationwide [39,40], but these numbers are limited to registered medical users and do not account for use in states where medical users may be purchasing cannabis through recreational markets.

Survey work on cannabis use in South American countries is becoming established with recent college student samples across multiple countries and cities. These studies suggest growing use rates among young adults, but not necessarily increased problems with use [41-43]. For example, a large survey across 10 South American cities suggested that college students had favorable views of cannabis as being potentially beneficial to mental or physical health in addition to being of little to no risk. Seventy percent of these respondents also agreed that cannabis should be legal for medical use or both recreational and medical use [42].

Despite this recent growth in the literature in the US and internationally, there is little data that examines granular use patterns in terms of mode of administration or product potency of various cannabinoids such as $\Delta 9$-tetrahydrocannabinol (THC) and cannabidiol (CBD). Some notable exceptions have come from the "Cannabis and Your Health" project at the Center for Health and Neuroscience, Genes, and Environment (CUChange, Boulder, CO, USA), which has reported on use patterns [44], potencies [45], and motivations [46,47]. However, all of the aforementioned studies were conducted in English among

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[1]The authors acknowledge that there is debate around the use of the terms "Hispanic," "Latino/a," "Latinx," and "Chicano/a," that there is a relationship of some of these terms to past historical abuses or inequities, and that these terms have not been consistently applied in the literature. For the purposes of this manuscript, terms shall be applied as used in the literature being referenced whenever possible.

a largely White, non-Hispanic sample. Thus, the cannabis research field may be underrepresenting the usage patterns, beliefs, and opinions surrounding cannabis use in diverse groups such as Spanish-speaking communities.

### Spanish Language Speakers in Cannabis and Health Research in the United States

The extant literature concerning cannabis and self-identified Hispanic cohorts is limited. Some studies have analyzed broad substance use patterns in national survey samples in a manner similar to the NHIS study [48], whereas other surveys have taken more focused approaches, for example either regionally [49] or by acculturation status [50]. The two studies cited here, both conducted in South Texas, explored the relationship between acculturation status (the combination of behaviors and beliefs of one's culture of origin and culture of current residence) and cannabis use. However, while Loza and colleagues found a positive relationship between acculturation and substance use rates, Mercado and colleagues found greater acculturation was a protective factor against increased cannabis use [49,50].

Even fewer studies specifically investigated knowledge of or attitudes towards cannabis, and were either framed specifically in terms of cultural orientation [30,51] or cultural values [52], were qualitative studies, or included small samples sizes [53-56] as opposed to large survey samples. However, these studies do provide important findings to inform future work. For instance, family stability and bilingualism were associated with less problematic substance use [51], and some traditional values such as *respeto* (respect for elders and family) were protective against problematic use, while others such as familism or fatalism were risk factors [57]. Some respondents reported that fear of deportation precluded any kind of cannabis use [55], while others showed acceptance for mental health-motivated use [58].

One survey study comparing Hispanic Americans who were either English speakers or Spanish speakers found that Spanish speakers had less accurate information about cannabis laws and more negative views of cannabis as risky and leading to negative health outcomes [56]. The literature search did not result in any other survey-based studies of medicinal use of cannabis among English- or Spanish-speaking Hispanic cohorts, nor include any cannabis specific measures such as product potency or granular usage pattern details.

### Barriers to Conducting Cannabis and Health Research in the US

Unfortunately, there are a number of barriers to conducting research in the US. As a Schedule I drug, the only federally legal source of cannabis for research is the NIDA drug supply program, the products of which are not comparable to the legal market [54]. Legal market cannabis also cannot be studied on campus in order to remain in compliance with the Drug Free School Act. Thus, research on the real-time risks or potential benefits of using cannabis products, including measures associated with acute use, cannot move forward using traditional laboratory designs. This critical fact underscores how survey data becomes increasingly important to help researchers understand real-world cannabis use; understanding of the actual product types or potencies that people are using in the world can inform study designs to improve the external validity and potentially the translatability of controlled laboratory research.

Second, collecting data about cannabis use is likely hindered by stigma. Existing data suggest that stigma against substance use is stronger for women [59] and adolescents, and discussion of substance use is hindered by fear of association with "criminal" or "addict" stereotypes [60]. Another study suggested that media portrayals of communities of color, women, or people with lower socioeconomic status using cannabis have more negative connotations than portrayals of males, Whites, and celebrities [61]. Finally, a study on stigma and medical cannabis found that cannabis-related stigma was negatively associated with willingness to participate in cannabis-related research [62].

Third, there is limited literature regarding stigma in the Spanish-speaking community around substance use. Some hypothesize that an unwillingness to discuss mental health or seek treatment is an avoidance of "double stigma" from the ongoing experience of discrimination [63] or from dissonance with cultural and familial values [64-67]. One study comparing Hispanic and African American church members demonstrated significantly higher stigma against drug addiction among Hispanic study participants, and lower English language proficiency was associated with higher levels of stigma [68]. Hispanic-specific, stigma-related research on cannabis is even less developed, limited to one study with a 33% Latino sample that suggested medical use is associated with greater stigma if use is for psychological, as opposed to physical symptoms [69].

### Contribution to The Literature and Implications for Future Research

In sum, research on real-world cannabis use patterns, particularly for medically motivated use is lagging behind the rapid expansion of legalization and subsequent increase in cannabis use among the general population. This data is particularly scant for Spanish-speaking communities in the United States and internationally. This may be due to many factors, including stigma surrounding substance use and mental health, fears of legal problems

and immigration-related persecution, and likely above all else, a historic underrepresentation of Spanish-speaking communities in biomedical research overall.

The Hispanic community in the US and internationally is richly diverse and rapidly growing. There is a need to expand equitable research attention to this important group, not just as a demographic in comparison to others, but in a way that begins to reveal important *within-group* differences, which in turn may have implications for future research on and potential treatment with cannabis. Given how small the literature is currently, survey-based research can be a critical first step to gathering ecologically valid data on real-world use towards thoughtfully informing future experimental or public health research.

### Study Aims

The foremost aim of this study was to collect data among Spanish-speaking communities on cannabis use that specifically characterizes granular demographic information, medically motivated and recreational use patterns and potency of products, medical motivations for use, and what perceptions are held as to risks and benefits. The rationale behind this approach is two-fold. First, there is not yet published work that adequately characterizes Spanish-speaking user profiles and use patterns from which to develop more sophisticated hypotheses, and thus it is hoped that this work will inform subsequent investigations. Second, it is not only a unique opportunity to examine cannabis use among an underrepresented group in the US, but also an opportunity to examine whether there are differences between Spanish-speakers in the US, in other countries, or for those who do not wish to disclose their location, as well as between users and non-users on perceptions of effects. While these analyses of group differences are exploratory, significant results may suggest that the effects of legal status should be further explored in future research. Finally, the relationship between acculturation status and use patterns, potency, and medical motivations for use were also examined in exploratory analyses given the focus on this construct in previous work.

### METHODS

#### Study Design and Procedures

A voluntary, anonymous survey that aimed to assess cannabis use patterns and beliefs in relation to health was first developed in English and launched online in 2017. Subsequently, the survey underwent a three-stage translation process for use in Spanish. First, translation was completed by a professional translator. Second, qualitative feedback on the Spanish translation of the survey was collected during a focus group to ensure both linguistic

and metaphorical equivalence with the English language version of the survey. Previous studies on research conducted among underrepresented groups and on multi-lingual survey translation and validation has shown that despite accurate linguistic translation there is still a risk for "metaphorical nonequivalence," or a neglect to match "figurative expressions that encode cultural constructs" [70-72]. The translation was then back-translated for final verification by bilingual research team members before being entered into a Research Electronic Data Capture project [73] that was subsequently linked to an online portal. The portal was linked to online research portals such as mTurk or Prolific or was administered in person through a community-based recruitment effort.

#### Participants and Study Criteria

Participants were eligible to participate if Spanish was their native or primary language and they were over age 21 per Institutional Review Board (IRB) guidelines. Participants who were recruited through mTurk or Prolific completed brief screening questionnaires and if eligible, completed the survey independently. Participants who were recruited in person were administered a brief informational and informed consent interview and if they wished to participate, subsequently completed the survey independently on iPad tablets. Focus group participants received an honorarium for their time. mTurk and Prolific participants received a nominal honorarium per the requirements of each platform, while in-person participants did not receive payment. All procedures were reviewed and approved by the IRB.

#### Measures

Measures included a combination of novel and validated items as described below. All presentation forms of the survey either had the option to skip questions entirely (website linked and in-person/iPad) or to select "prefer not to answer" (Prolific and mTurk). The completion of all questions was required for Prolific and mTurk in order to verify participation.

#### Demographics

Demographics included gender (male, female, non-binary, or self-describe) age, relationship status, education level, employment status, veteran status, race and ethnicity, and zip code or location data. Of note, and as with all other survey items, location data was not required for survey participation, given the unique challenges associated with immigration policy and law.

#### Health and Mental Health

A series of seven questions asked participants to rate

aspects of their physical or mental health as "excellent/excelente," "very good/muy bueno(a)," "good/bueno," "neutral/Ni bueno ni malo," or "poor/pobre." The internal consistency of the measure was adequate (alpha = 0.90).

## Marijuana Dependence Scale (MDS)

The MDS is a previously validated 11-item self-report assessment of dependence severity [74]. The MDS is widely utilized in studies that assess marijuana dependency in a variety of populations [75-77]. Higher scores correspond to higher levels of dependence (alpha = 0.69). The question stem for the scale states "The following is a series of questions about problems that are sometimes related to cannabis use. If you have experienced any of these symptoms in the last 12 months, please mark "YES." Otherwise, please choose "NO." During the past year..." and is followed by 11 items related to problematic use (eg, "did you ever miss work or school because of your cannabis use/ ¿Faltó al trabajo o a la escuela por estar usando marihuana?").

## Bidimensional Acculturation Scale (BAS) for Hispanics – Linguistic Proficiency Subscale

The BAS is validated in English and Spanish [78] and is inclusive of three subscales (language use, linguistic proficiency, and electronic media). Among these subscales, the 12-item linguistic proficiency subscale was used (alpha = 0.86). One example item from this subscale includes "How well do you understand television programs in English? ("¿Qué tan bien entiende los programas de televisión en inglés?") with four response options ranging from 1 ("very well/muy bien") to 3 ("very bad/muy mal"). Higher scores correspond to higher acculturation levels.

## Marijuana Consumption Questionnaire (MCQ)

The MCQ is a novel measure that assesses frequency and quantity of cannabis use, age of first use, and availability of cannabis. Frequency and quantity of use is collected according to mode of administration and is inclusive of smoking, vaporizing, edible (ie, capsules, food, drinks), topical, and concentrate (high potency THC) use. Each section begins with the question stem "About how often do you…" ("¿Alrededor de qué tan seguido…") that is applied to each type of administration. Response options from "I never.." (eg, "Nunca fumo ni vapeo marihuana") to "Every day" ("Todos los días"). Respondents who endorse any use of a product type are then asked how many times per day ("¿en promedio cuantas veces al día lo hace?"), how much, and what proportions of THC and CBD are used. Response options varied by product type. The internal consistency of the measure for use days (the stem item for each product category) was adequate

(alpha = 0.69).

## Marijuana Effect Expectancies Questionnaire (MEEQ)

The MEEQ is a previously validated measure that includes six items gauging expected effects of cannabis use [79] (alpha = 0.60). All participants could provide responses to the MEEQ whether or not they were cannabis users. Of the six items, three were positively oriented (Marijuana improves relaxation, interpersonal skills, or creativity; eg, "La marihuana ayuda a las personas a relajarse y sentirse menos tensos, (les ayuda a las personas a disfrutar y sentirse tranquilos)") and three negatively oriented (Marijuana makes it harder to think, causes depression or anger, causes hunger, dry mouth or non-stop laughing; eg, "La marihuana hace que sea más difícil pensar y hacer cosas (es más difícil concentrarse y entender; hace que la gente se vuelva más lenta cuando se mueve)"). Respondents indicated how much they agree with each statement, from "strongly disagree" to "strongly agree."

## Medically Motivated Cannabis Use

A series of questions that begin with the stem "do you use cannabis to treat or mitigate…" ("¿Usa la marihuana para aliviar o mitigar…") and that include the most common reasons for medical use cited in the current literature: chronic pain, migraines, anxiety or depression, cancer symptoms, PTSD symptoms, and sleep problems. Response options include "yes/si," "no/no," "not current but interested in using it/ No actualmente pero estoy interesado(a) en usarla ," and "I used it before to help but I am no longer using it/ Use la marihuana para ayudar pero ya no la uso."

## ANALYTICAL APPROACH

Analyses were conducted in R Studio [80]. Descriptive statistics of the whole sample as well as tests of group differences were conducted. The sample was divided into three groups: US, international, and unknown location, and for the MEEQ, into users and non-users. Of note, demographics and response types were not collapsed whenever possible, towards the goal of taking a more equity-focused approach to analysis [34]. For example, participants could select multiple racial or ethnic identities at once and all selections are reported in full detail. Reference groups are reported in tables for clarity, but specific ethnic, gender, or other identity-based categories were not used as comparison groups. Additionally, granular details on use frequencies or potencies were not collapsed whenever possible. To facilitate this approach, an ANOVA was applied to each continuous variable to as-
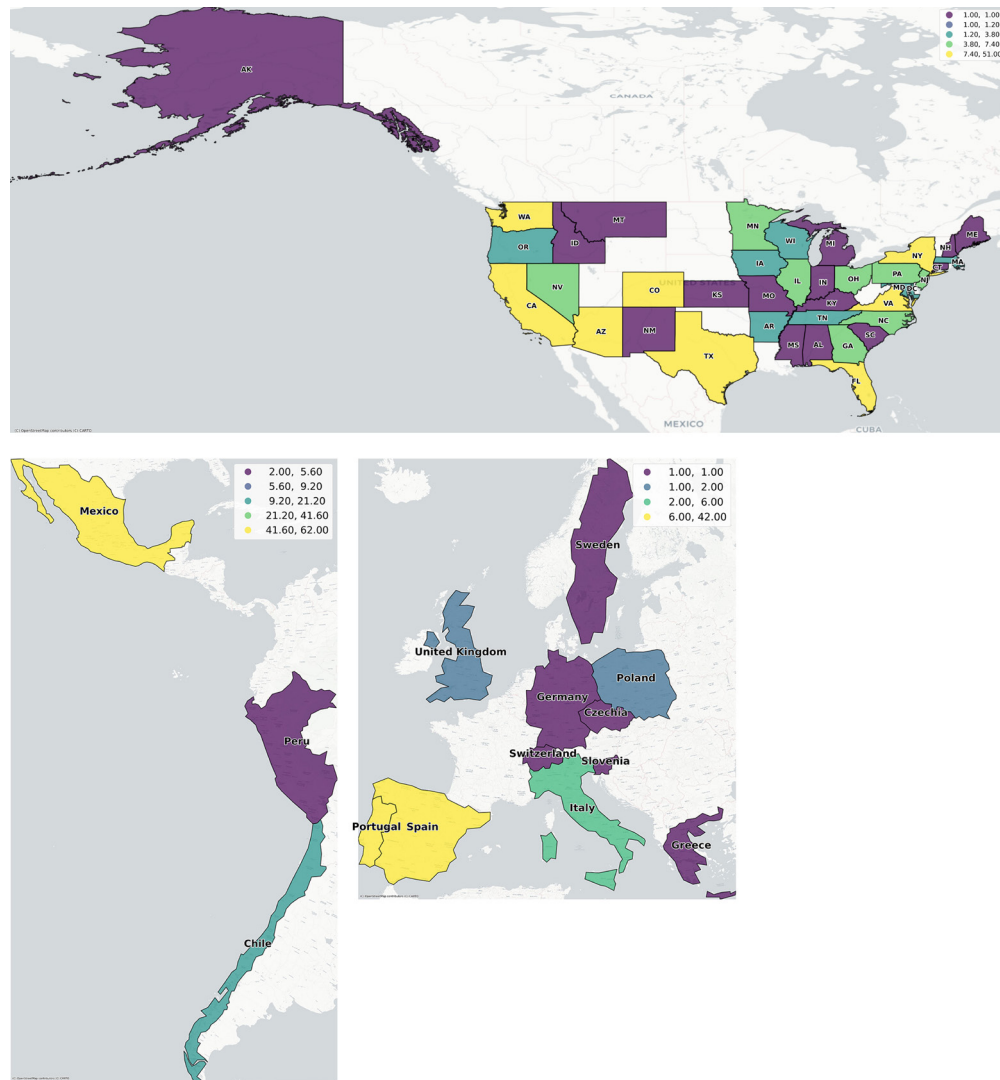
**Figure 1**. **Survey Respondent Locations**. Legend indicates range of number of respondents for each color code.

sess for significant group differences. If group differences were present, Tukey's HSD post-hoc tests were applied to identify specific differences across the three groups. For categorical variables, chi-square tests were applied across all possible combinations of groups and outcomes to identify specific significant differences.

For the second, exploratory aim, Spearman's rank correlations were applied to assess the relationship between scores on the bidimensional acculturation scale and cannabis use frequency, product amounts, and cannabinoid potencies given the latter data were nonparametric. Finally, to examine the relationship between scores on the bidimensional acculturation scale and medical motivations for cannabis use, an ANOVA was applied to assess for significant differences between response types for each medical condition. If differences were present, Tukey's HSD post-hoc tests were applied to identify specific differences in relation to BAS scores.

## RESULTS

*Full Sample Characteristics*

Five hundred forty-nine individuals completed the survey, including 294 residing in the US ($M_{age}$ = 31.8, $SD$=9.72; 154 women, 137 men, 3 non-binary and self-described individuals), 174 residing outside of the US (International) ($M_{age}$=26.6, $SD$=8.75; 77 women, 96 men, 1 non-binary and self-described individuals), and 81 who did not report country of residence (Unknown location) ($M_{age}$ = 26.7, $SD$=7.37; 17 women, 61 men, 3 non-binary and self-described individuals). The distribution of respondents by location within the US and the international groups are visualized in Figure 1. Over half of the sample self-identified as Hispanic or Latino only. Additionally, slightly more than 11% of the sample identified as two or more races or ethnicities (see Figure 2). The mean BAS score for the sample was 30.9 ($SD$=4.90),
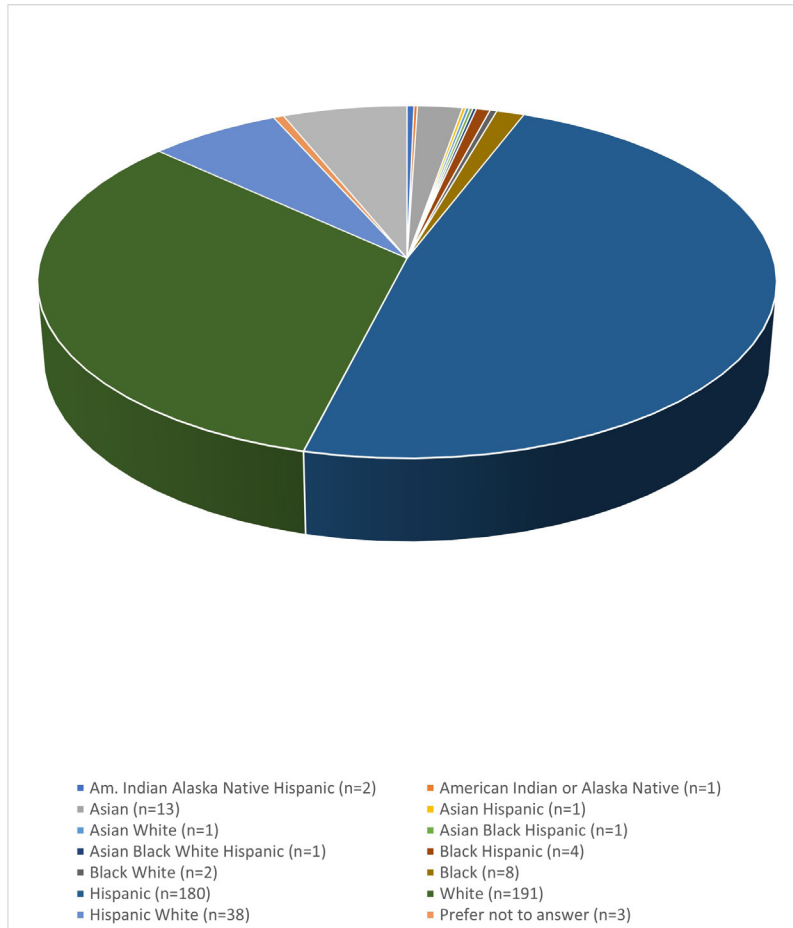
Legend:
- Am. Indian Alaska Native Hispanic (n=2)
- American Indian or Alaska Native (n=1)
- Asian (n=13)
- Asian Hispanic (n=1)
- Asian White (n=1)
- Asian Black Hispanic (n=1)
- Asian Black White Hispanic (n=1)
- Black Hispanic (n=4)
- Black White (n=2)
- Black (n=8)
- Hispanic (n=180)
- White (n=191)
- Hispanic White (n=38)
- Prefer not to answer (n=3)

**Figure 2**. **Full Sample Ethnicity/Race**.

suggesting a high level of acculturation across all groups based on the metrics of consumption of English language media and bilingual proficiency as measured by the Linguistic Proficiency Subscale. The mean MDS score was 1.23 ($SD$=1.69), suggesting very low levels of cannabis dependency in the sample. Sample and group summary demographics and attributes are described in Table 1. Results from the full sample on the various measures within the survey are reported first, followed by reporting of group comparison and acculturation association results.

*Cannabis Use Patterns*

Fifty-five point six percent of respondents endorsed either using cannabis currently or planning to use cannabis in the future ($n$=298). The question of how old a respondent was when they first tried cannabis was included but a majority of individuals did not respond ($n$=514), and thus will not be reported (the question was omitted from some presentations of the survey due to technical error). The most endorsed form of current use was smoking or vaping ($n$=197), followed by edibles ($n$=151), topicals ($n$=81), and concentrates (eg, hash oil, shatter, wax,

or cartridges with extremely high THC concentrations) ($n$=70).

*Smoking and Vaping*

Respondents reported smoking or vaporizing cannabis anywhere between less than once a month to daily, but most commonly less than once a month to once a month. Single session cannabis amounts used ranged from 0.1 to 0.25 grams, though 19 individuals responded "other," suggesting either higher, lower, or unknown quantities. THC and CBD proportions were also heterogenous, ranging broadly from 0 to more than 35% for both cannabinoids.

*Edibles, Topicals, and Concentrates*

Respondents reported using edible cannabis anywhere between less than once a month to daily, but most commonly less than once a month to once a month. Most respondents used edibles only once on the day they used them, but a quarter of the sample reported using edibles twice on days they used them. Like smoked or vaporized cannabis, cannabinoid proportions per day were

**Table 1. Demographics and Attributes of Full Sample and Groups**

|  | Full Sample (N=549) | US (n=294) | International (n=174) | Unknown Location (n=81) |
|---|---|---|---|---|
| Age (Mean(*SD*)) | 29.4 (*9.45*) | 31.8 (*9.72*)* | 26.6 (*8.75*)* | 26.7 (*7.37*)* |
| Female & non-binary (%(*n*)) | 47.6% (*255*) | 53.1% (*156*)* | 44.8% (*78*)* | 24.7% (*20*)* |
| Relationship: Single (%(*n*)) | 46.3% (*248*) | 40.1% (*118*) | 47.1% (*82*) | 59.3% (*48*) |
| Race/Ethnicity: Hispanic (%(*n*)) | 52.2% (*280*) | 57.5% (*169*) | 44.3% (*77*) | 42.0% (*34*) |
| Education: Bachelors degree (%(*n*)) | 35.6% (*191*) | 33.7% (*99*) | 39.7% (*69*) | 28.4% (*23*) |
| Employment: Full-time (%(*n*)) | 44.2% (*237*) | 52.7% (*155*)* | 31.6% (*55*)* | 33.3% (*27*)* |
| Smoking/vaping current or past use (%(*n*)) | 36.8% (*197*) | 36.7% (*108*) | 29.9% (*52*) | 45.7% (*37*) |
| Edible current or past use (%(*n*)) | 28.3% (*151*) | 29.3% (*86*) | 20.7% (*36*) | 29.6% (*24*) |
| Topical current or past use (%(*n*)) | 15.1% (*81*) | 20.7% (*61*) | 9.77% (*17*) | 8.64% (*7*) |
| Concentrate current or past use (%(*n*)) | 13.1% (*70*) | 16.3% (*48*) | 8.62% (*15*) | 8.64% (*7*) |
| BAS (Mean(*SD*))[a] | 30.9 (*4.9*) | 32.8 (*3.8*)* | 28.5 (*5.27*)* | 30.1 (*4.84*)* |
| MDS (Mean(*SD*))[b] | 1.23 (*1.69*) | 0.99 (*1.57*)* | 1.36 (*1.75*) | 1.91 (*1.84*)* |
| Global health rating (Mean(*SD*))[c] | 17.6 (*5.95*) | 17.5 (*6.40*) | 17.5 (*5.32*) | 18.3 (*5.60*) |

*Asterisks indicate significant differences between group mean values (p<0.05). [a]Bidimensional Acculturation Scale – Linguistic Proficiency Subscale items are rated from very well (1) to very bad (4). Higher scores correspond to greater acculturation levels. [b]Marijuana Dependence Scale items are rated 1 (yes) or 0 (no). Higher scores correspond to higher dependence. [c]Health items are rated from 1 (excellent) to 5 (poor). Higher scores correspond to worse health status.

heterogenous, ranging broadly from <5mg to 60mg for THC and up to 100mg for CBD. Respondents reported using topical cannabis or concentrates anywhere between less than once a month to daily. It was most common for either substance to be used less than once a month. As would be expected, most topicals had <5mg of THC, but surprisingly, many concentrate users reported THC levels below 35mg.

### Marijuana Effect Expectancies Questionnaire (MEEQ)

Study respondents were most likely to agree or strongly agree that cannabis aids in relaxation (84.1%) and least likely to agree that cannabis causes negative effects like anger, carelessness, or depression (34.9%). Roughly 77% of respondents agreed that cannabis causes physical symptoms like laughing, hunger, or dry mouth, 70% believed that use increased creativity, and 61% believed that use impaired thinking. In contrast, approximately 44% believed that cannabis improved interpersonal skills or increased sexual feelings.

### Medically Motivated Use

One hundred eighty-seven respondents endorsed current medically motivated use. Reports of medically motivated use were varied across the whole sample and within groups. Depression or anxiety was the most common reason for use (*n*=76), while respondents were also using cannabis for chronic pain (*n*=60), migraines

(*n*=21), PTSD symptoms (*n*=10), sleep problems (*n*=9), and pregnancy related symptoms (*n*=2). While no one reported using cannabis for cancer symptoms and cancer treatment side effects, 1 person reported an interest in starting. Over 100 respondents also reported interest in initiating cannabis use for chronic pain (*n*=57), anxiety or depression (*n*=49), migraines (*n*=18), PTSD (*n*=4), or sleep problems (*n*=1). Over 40 respondents reported using cannabis for one of these reasons in the past but that they are no longer using it for that reason.

### Group Differences by Location

There were significant differences between groups in age, $F(2,532)=21.24$, $p<0.001$. Based on Tukey's HSD tests, the US group was older than the international group (difference=5.19, $p<0.001$), and unknown location group (difference=5.05, $p<0.001$). The difference between groups on gender was also significant, $\chi^2(28.37)=4$, $p<0.001$, such that the Unknown location group had a higher proportion of men and non-binary or self-described individuals than the international group, and the international group had a higher proportion of men than the US group. The difference between groups on BAS was significant, $F(2,503)=46.49$, $p<0.001$, such that US BAS scores were higher than both other groups (international difference=4.23, $p<0.001$; unknown location difference=2.70, $p<0.001$), and the unknown location group was higher than the international group (difference=1.53, $p=0.03$). Differences between groups on the
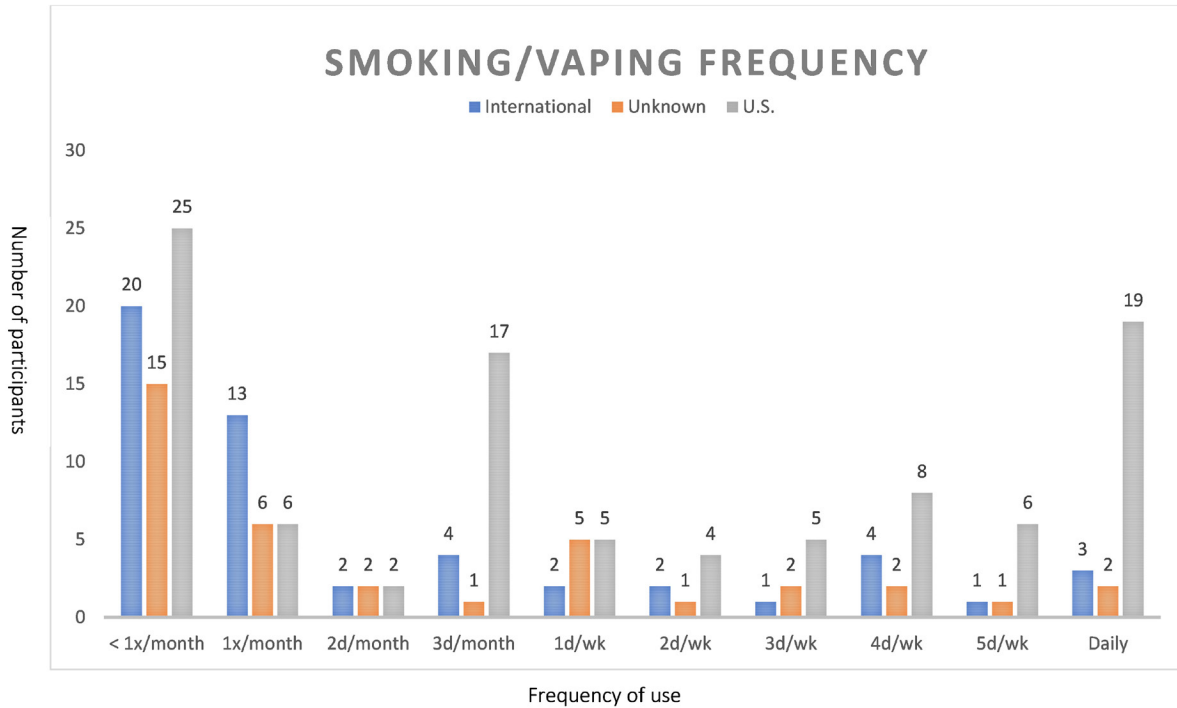
**Figure 3**. **Smoking and Vaping Frequencies by Group**. **< 1x/month** = less than once per month. **1x/month** = 1 time per month. **2d or 3d/month** = 2 days or 3 days per month. **1d through 5d/wk** = 1 through 5 days per week.

MDS were also significant, $F(2,269)=5.38$, $p=0.01$, such that the unknown location group scored higher than the US group (difference=0.92, $p<0.001$). Group differences are summarized in Table 1.

### Cannabis Use Patterns

Though recreational use was most common, the difference between groups on use reason type (how often one uses recreationally versus medically) was significant, $\chi^2(53.24)=14$, $p<0.001$. Post-hoc comparisons showed that the US group was more likely than both other groups to use cannabis about half the time for recreational purposes and half the time for medical purposes.

### Smoking and Vaping

The difference between groups on smoke or vape days was significant, $\chi^2(48.46)=24$, $p<0.001$. Individuals in the US group reporting smoking or vaping significantly more frequently than the other two groups and were more likely to be daily smokers (international=3, US=19, unknown location=2) (Figure 3). While the difference between groups on amount smoked was not significant, the differences between groups on THC was significant, $\chi^2(31.69)=18$, $p=0.02$. Specifically, US respondents were more likely than both other groups to smoke products with THC concentrations of 0% to 15% and were more likely to smoke cannabis with higher THC concentrations (20% to >35%).

### Edibles, Topicals, and Concentrates

There were no significant differences in frequencies of use or potencies of products across groups for edibles, topicals, or concentrates.

### MEEQ and Medical Use

There were no significant group differences by location or according to whether respondents were users or non-users for any of the medical use reasons or on the responses to the MEEQ. In contrast, users (respondents who reported current or past cannabis use) and non-users differed significantly on every measure of the MEEQ with a significance level of $p=0.006$ or less (Figure 4).

### Exploratory Analyses of BAS, Use Patterns, and Medically Motivated Use

Spearman's rank correlational analyses were executed on BAS for the whole sample against smoking/vaporization, edible, topical, and concentrate use for 1) use frequency, 2) use amount per session, 3) THC potency, and 4) CBD potency and there were no significant correlations. Given the significant differences between groups on BAS scores, a post-hoc series of the same analyses were then executed for the US sample only, but there
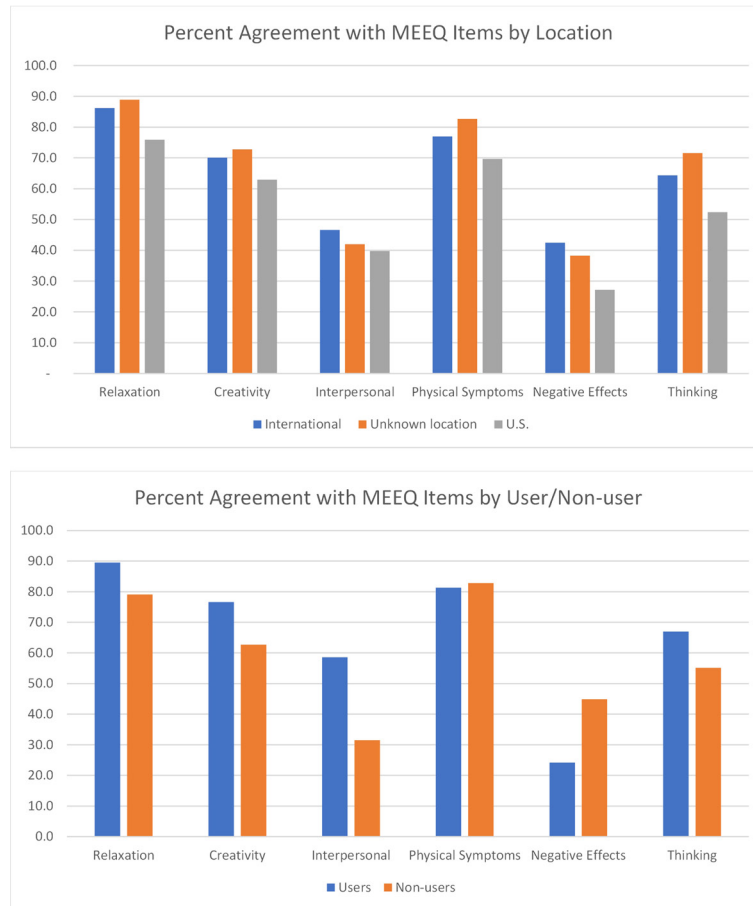
**Figure 4**. **MEEQ Statement Agreement by Groups (location and user/non-user)**. **y-axis**: proportion (%) of respondents in group who 'agree' or 'strongly agree' with statement. **Relaxation**: "Marijuana helps people relax and feel less stressed (it helps people enjoy themselves and feel calm)." **Creativity**: "Marijuana makes people feel more creative and perceive things differently (music sounds different, it seems more interesting). **Interpersonal**: "Marijuana helps people get along better and can help a person feel more sexual (talk more, feel more romantic)." **Physical Symptoms**: "Marijuana has effects on a person's body and causes cravings (causes hunger, dry mouth, hard to stop laughing)." **Negative Effects**: "In general, marijuana has bad effects on a person (people get angry or careless, after feeling euphoria the person feels depressed)." **Thinking**: "Marijuana makes is harder to think and do things (it's more difficult to concentrate and understand; it makes people become more slow when moving)."

were no significant correlations.

As previously reported, the five most common medical reasons for cannabis use in the sample were anxiety/depression, chronic pain, migraines, PTSD, and sleep. Thus, these conditions were selected to be included in the series of ANOVAs against BAS score, but there were no significant differences in response type for any of the five conditions across the whole sample. Once more, a post-hoc series of the same analyses were then executed for the US sample only, again yielding no significant correlations.

## DISCUSSION

The present study provides novel, granular data collected among Spanish-speaking communities that describes medically motivated and recreational cannabis use patterns, potency of products, medical motivations for use, and what perceptions are held as to the risks and benefits of using cannabis, including interesting differences and many similarities between groups from the US, outside of the US, and with an undisclosed location.

This study took a nuanced approach to demographics that revealed the respondents to be a highly diverse group, with more than 11% identifying with multiple racial or ethnic categories. This would have otherwise

been obscured by the common practice to collapse categories. It should be noted however, that "Hispanic" in the United States is often meant to refer to all native Spanish speakers, while "Latino/a" refers to those who have immigrated from or are descended from Latin American countries for the purposes of the US Census [81]. Additionally, many Spanish speakers who live in the US but are native to, or descended from, those native to Mexico prefer the terms "Chicano/a." Thus, these terms may variously not be considered self-applicable by Spanish speakers in different locations, where individuals may consider themselves White or other ethnicities. This study also did not exclude individuals who identified as non-binary, nor collapse groups of individuals across any categories of self-identification. It was also a strength of the sample that respondents were generally older than most participants in cannabis research [33]. These are all important first steps in taking an equity-focused approach to cannabis research that are needed to improve the generalizability of findings across more diverse groups [34].

It was reported that Spanish-speakers use cannabis for both recreational and medical reasons and held an overall positive view of the effects of cannabis despite previous, albeit limited literature suggesting stigma against use [82,83]. This is important taken together with results indicating that medical use was common among the sample, even for mental health concerns such as anxiety and depression. Results of the MEEQ for the whole sample suggested that a majority of respondents in the whole sample believed that cannabis aided in positive affective or cognitive states such as relaxation, while relatively fewer believed cannabis contributed to negative effects like anger or carelessness. It is noteworthy however, that while there were no significant differences in views by location, users and non-users significantly disagreed on *every item* of the measure, with non-users generally taking a less favorable view. While not unexpected, this is a remarkable finding in light of previous work suggesting that language or acculturation, and not other factors such as user status, are related to views of cannabis use [56]. On the one hand, it may be that current or past use status is an especially strong driver of perceptions and behaviors above other factors previously explored in the literature. On the other, our contrasting findings compared to Roppollo and colleagues' study of Spanish speakers may be at least in part explained by our greater geographical reach and the fact that the latter study was conducted over five years ago. These findings nonetheless underscore the need for expanded, focused research in diverse or non-English-speaking groups, in addition to the need to communicate effectively with all communities about the risks and benefits of cannabis that are known so far. Additionally, future work could investigate differences between Spanish and English speakers,

but we would recommend that it not be done in a binary fashion (Spanish versus English), which can inadvertently situate dominant groups as *de facto* default categories or standards to which all others are compared [34,84]. For example, comparisons could be made across more granular ethnic or racial categories and controlling for language.

This study revealed interesting data on how cannabis is being used by Spanish speakers in the US and internationally. It is not surprising that smoking and vaporization were the most frequently reported modes of administration, given that inhalation is traditionally most common [85-87]. However, there was diversity of use across the sample in that all modes of administration, including less common forms such as topicals. It could be argued that significant group differences between use levels for other substances such as edibles or topicals would have been expected given that they are more common on legal markets [88], but no differences were observed. Relatedly, some interesting patterns emerged as to the potency of products, which may be due more to how products are procured, or in the case of legal markets, packaged and labeled.

Alternatively, international users may have different nomenclature for various types of cannabis. For example, a recent international study classified use into categories like "sinsemilla," "hashish," or "herbal" [85], terms that were not used in this study. Some concentrate users also reported THC levels below 35% despite the fact that concentrates often maximize proportions of THC, resulting in potencies upwards of 75%. This may again be a result of how products are marketed or what names they are known by (eg, in some countries, high potency THC use is primarily with kief, a cannabis flower derivative). It could also be that resin or wax users (common forms of concentrates) in other locations besides the US choose this mode of administration for other reasons besides THC potency, such as a preference for rapid onset of effects. Future work should try to understand how these alternative methods of administration are proliferating, perhaps with longitudinal observational studies, or with an examination of use patterns in relation to legal market status. This data could also be useful in designing laboratory based controlled studies, informing dosing and administration levels that are more consistent with real world use.

Interestingly, despite an existing body of work that suggests acculturation is related to mental health and health behaviors in addition to substance use [89-92], this study found no associations between BAS scores and use frequency, amount, potency, or administration type, nor with medical motivations for use. It may be related to the fact that most of the previous work has been conducted among Spanish-speaking adolescents for whom accultur-

ation may be more salient than for adults, or specifically with disordered substance use [93-97]. Additionally, due to the length of the survey, only the linguistic subscale was used in this study that, while validated for use on its own, may not have been sensitive enough to other aspects of acculturation potentially related to cannabis use patterns. Finally, the construct itself may have limitations [98,99] or given the rapidly evolving climate around cannabis use worldwide, acculturation may not be as relevant to use as it was before increasing legalization. This could be especially true in regard to medically motivated use, which is becoming more common worldwide and is often the first kind of use to become legalized such as in Argentina, Chile, or the US.

This study had notable strengths, but also limitations that could be addressed in future work. First, given that the survey included detailed questions across broad domains, some measures such as the BAS were used in shortened form to help keep the survey at a manageable length. Future studies could focus on the relationship between acculturation and one other area such as use patterns for example, to enable the use of the longer form of the measure and take an even closer look at specific relationships. Second, certain user groups such as pregnant and nursing women or cancer patients were underrepresented in this study, and thus no meaningful conclusions could be drawn about their use or perceptions. Future studies could use the data presented here to target important groups such as these and learn more about how they are using cannabis in the real world. Third, data collection was both through traditional, unpaid recruitment and through online survey platforms that provided participants with nominal incentives. This difference in recruitment styles may have precipitated differences between platform-based and non-platform-based respondents that were not examined here.

## CONCLUSION

The current study takes an equity-focused approach to provide critical, early data from an understudied group. It reveals that Spanish-speaking communities in the US and internationally have both shared and divergent cannabis use patterns, particularly for smoking or vaporizing, medical use, and perceptions of safety or risks of using cannabis. Future work should continue to leverage engaged partnerships to foster trust in the community. These data will help to improve representation in the field of cannabis and health research, and empirically inform future research with this diverse and growing international community.

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