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Cognitive Evaluation of Revised Questions on Cannabis Product Use

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INTRODUCTION

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This report documents the findings from a cognitive interviewing study by the Collaborating Center for Questionnaire Design and Evaluation Research (CCQDER), National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), of a set of questions on experiences with cannabis products, including marijuana and hemp products, for the CDC's National Center for Injury Prevention and Control (NCIPC), Division of Overdose Prevention (DOP). The questions are intended to be used on national- and state-level surveys of adults and cover topics including hemp and cannabidiol (CBD) use, marijuana use, modes of use and of product acquisition, the use of cannabis alongside and as a replacement for other substances, cannabis-impaired driving, physician-patient interactions related to cannabis, cannabis advertising, adverse effects of cannabis use, and the effect of changing laws on cannabis use. The questions were initially developed by DOP in consultation with other state and federal agencies and the Council for State and Territorial Epidemiologists' (CSTE) Cannabis Subcommittee. Subsequently, the questions were cognitively evaluated by CCQDER and revised prior to this round of evaluation (1).

This study was conducted using cognitive interviewing, a question evaluation method that provides rich qualitative insights into how respondents engage with survey items. Specifically, cognitive interviewing assesses respondents' patterns of interpretation, recall, judgment, and response to each item and across items. CCQDER's question evaluation methodology builds on the socio-cultural approach articulated by Gerber and Wellens (2) and further elaborated by Miller (3) and Miller et al. (4). It aims to document how respondents understood each question, to assess and categorize response processes based on those interpretations, and to establish constructs captured by each question and by the broader instrument. Cognitive interviewing data are analyzed using a four-stage process based on the constant comparative method first articulated by Glaser and Strauss and adapted to cognitive interviewing by Miller et al (4, 6). CCQDER researchers conducted analysis using Q-Notes, a publicly-available online software application designed for managing data from cognitive interviewing.[1]

This activity received both Office of Management and Budget (OMB) and NCHS/CDC Human Subjects approval.

[1] Q-Notes can be accessed at https://wwwn.cdc.gov/qnotes/.

METHODOLOGY

Sample composition and recruitment

Researchers from CCQDER and Research Support Services (RSS) conducted 45 interviews in English using the Zoom video conferencing platform between April and August 2024. Sampling was purposive, with selection based on two criteria. First, CCQDER recruited respondents based on cannabis product use and experience, including both cannabis product users and nonusers. Second, CCQDER recruited respondents to develop a diverse sample with participants from various age, sex, race, and ethnicity groups, as well as at varying levels of educational attainment. The sample generated in this study is not representative, but instead was constructed to identify the broad range of theoretically meaningful patterns of interpretation present for the purpose of question evaluation and improvement prior to fielding. Details of recruitment, including the screening questions used to categorize participants, can be found in Appendix 2.

Table 1 describes the study sample. The sample had more women than men. It was predominantly non-Hispanic Black or African American. Respondents in this study tended to be middle-aged, and most respondents did not have a four-year college degree or higher educational attainment. Most respondents came from states with legal marijuana for adult use.

Table 1: Distribution of cognitive interviewing sample by selected characteristics: United States, 2024

Characteristic and Category	Number
Sex	
Female	24
Male	21
Race/Ethnicity[1]	
American Indian or Alaska Native, non-Hispanic	1
Asian, non-Hispanic	1
Black or African American, non-Hispanic	24
Hispanic/Latino	6
White, non-Hispanic	15
Age (in years)	
18-29	9
30-49	17
50-64	12
65 and older	7
Educational Attainment	
High school diploma or less	14
Some college, including Associates Degree	14
4-Year college degree	14
Graduate degree	3
Respondent Jurisdiction Legal Status	
Adult use, medical or non-medical	28
Medical-only	7
CBD-only	10

FOOTNOTE: [1]Numbers add to more than 45 respondents because respondents could select more than one category.

NOTE: Sample $n = 45$.

SOURCE: National Center for Health Statistics, Collaborating Center for Questionnaire Design and Evaluation Research, 2024.

A full copy of the instrument is provided at the end of this report in Appendix 3.

Data collection and analysis

Interviews were a maximum of one hour long. Respondents completed informed consent and confidentiality forms prior to the interview and were remunerated $50 after interview completion. The interviews began with interviewers administering the survey questionnaire as designed and outlined in Appendix 3 by reading the questions aloud and, with as little intervention as possible, gathering respondents' answers. This was followed by retrospective probing of the instrument aimed at understanding why respondents offered the answers they did through understanding their personal narratives and social context (5).

Analysis for this study took place in four stages. In the first stage of analysis, interviewers summarized interviews into notes that conveyed respondents' social experiences and their impact on question response processes. Notes typically contained the interpretations respondents gave of key concepts (for example, their understandings of marijuana-related advertising), as well as descriptions of question scope (for example, products included), response errors, and difficulties faced when encountering the questions. Additionally, summary notes frequently contained reflections from interviewers on the probing strategies used to elicit respondent narratives, including the probes themselves. Finally, interviewers added their own notation of emergent findings to the notes when appropriate.

In the second stage, researchers drew inductive comparisons across the dataset on a question-by-question basis. This process had the aim of identifying patterns of 1) consistent (or inconsistent) respondent understandings of key concepts and 2) associations respondents had with those concepts. For this study, this process was particularly guided by the findings of CCQDER's previous evaluation, in which the primary determinant of question performance was the distinction respondents drew between "marijuana" and "hemp or CBD-only" products. In the third stage, analysts drew comparisons across subgroups within each question to determine if demographic and methodological subgroups understood questions substantially differently or similarly. Finally, in the fourth stage, analysts examined the entire instrument to identify cross-cutting conceptual themes relevant to how respondents, broadly speaking, answer questions about cannabis use and experiences, and the extent to which response processes differed between these revised questions and the previous version evaluated.

The current study continues the previous evaluation conducted by CCQDER in 2021 and 2022, though this initial evaluation was not conceived of as multi-round. For reference, a full copy of the previous study instrument is included as Appendix 4.

An overview of the key findings from the study is presented next, followed by a detailed question-by-question analysis of all items

RESULTS

This section details three principal findings that emerged across the questions. First, it discusses the impact of revisions to question wording that distinguished between types of cannabis-based products. These revisions incorporated a plain-language approach, asking respondents about whether the product they use is intended to get them "high" or not. Compared to earlier versions of question wording, this wording produced more consistent patterns of interpretation and product inclusion. Second, it examines the effect of mid-study changes to question order on potential response error. Even with revisions to question wording clarifying intended product categorizations, classification errors stemming from question order persisted before and after the changes, though these errors were relatively rare. Finally, it assesses the performance of these items among respondents who do not currently use cannabis and finds no evidence of response error in this study subgroup.

Finally, this section closes with a series of cross-item findings that apply to more than one question. These include variable interpretations and use of reference periods; similar recall patterns in questions that solicit information

about frequency of activities; and potential overreporting of purchasing activity for two questions related to marijuana and CBD product acquisition.

Plain-language revisions to question wording about cannabis product types

Questions included in this study referenced either "CBD products" or "marijuana." The instrument defined these terms through two questions that asked about overall product use within the past 30 days. The question referencing "CBD products" described these products as "cannabis products that are not intended to get you 'high,'" while the question referencing "marijuana" described this product as "the kind of cannabis that is intended to get you 'high,' including products like delta-8 THC." This distinction felt natural to respondents and aligned with their experiences, in contrast to earlier versions of these questions that did not provide definitions referring to the products' psychoactive (or non-psychoactive) effects (1).

Compared to versions of the items without the revised wording, the scope of respondents' interpretations and included products was narrower. In this study, respondents focused primarily on the distinction based on product effects articulated in the question wording, in contrast to earlier wording, where respondents focused on a variety of distinctions including but not limited to the one based on psychoactive effects (1). One respondent who used both CBD lotion for wrist pain and marijuana for non-medical use said, "when people see the leaf, they think marijuana. But there's another form that comes from the same plant that doesn't make you high. I was very happy that you asked about that because it's important that people know there's products that are beneficial." Another respondent who only used marijuana "for recreation purposes" said that "the aim when you are using [CBD] products is for medicinal purpose and doesn't cause someone to get high…THC products are meant to get someone high." Even respondents who had never used marijuana or CBD products understood this distinction; one explained that "there's a difference. A lot of [the CBD products] are used for skin or health reasons. They are not intended to get you high, but they are intended to improve your life. Whereas the marijuana you think of as intended to get you high. You know, smoking a blunt, smoking reefer."

Respondents' generally easy and natural use of the term "high" to refer to cannabis product effects reflects the importance of plain-language wording. While more complex wording, such as "psychoactive cannabis" and "non-psychoactive cannabis," might more accurately reflect the phenomenon of interest, using this wording is not typically recommended in the question design literature. Complex wording places increased burden on respondents and increases the potential for measurement error stemming from respondent confusion (7, 8).

Alternative distinctions

The product effects distinction was not salient for all respondents in this study, though this did not lead to response error. Two groups of respondents with conflicting product categorizations emerged. First, a group of respondents who had either never used marijuana or CBD products or who had only used these products more than twelve months prior to screening into the study found the distinction between products intended or not intended to get users "high" to be confusing. For example, one respondent who had never used any cannabis products thought that all CBD products contain THC, and consequently, all products give their user some type of high:

> *Respondent: …the THC is in everything, in all of the CBD stuff, and if it's in everything, then it's relaxing you. My understanding is that the THC chemical is some level of relaxer. So that it is in the oil or whatever other product, it all comes back to relaxation. Will it mentally tell you that the pain isn't there or will it physically relax the muscles or nerves or whatever is causing the pain, that I don't know exactly.*
>
> Interviewer: So, your understanding is that even CBD products have some THC?
>
> *Respondent: Yes. I mean, I don't know. But logic tells me it does.*

Another respondent who had used marijuana several years previously had seen "CBD products in the tobacco store." She continued,

> *And I asked what is it? Because some of the products is like weed. Some of it be like gummies. And they were like, it's like weed basically. It's like marijuana. It gets you high.*

This respondent identified that certain "CBD products" could get her "high" but reported seeing these products during probing of the question about products that were *not* intended to get her "high," because they were sold alongside other non-psychoactive products, such as tobacco. Importantly, though, no matter the nature of the confusion, there was no response error, because respondents correctly reported using none of the products in question. Rather, confusion among respondents who never used marijuana or CBD products, or who had only used these products more than a year prior to the study, may reflect poor latent understanding of the diversity and effects of currently available cannabis-related products.

A second group of respondents who used marijuana for medical purposes found the distinction between products that are intended to get the user "high" and those not intended to get the user "high" to poorly reflect their experience. In this study, these respondents were highly knowledgeable product users who had long histories of cannabis product use. For example, one respondent, who regularly used marijuana to treat a health condition and who had extensive experience with CBD products, explained that:

> *CBD products do get you high. They just activate different cannabinoid receptors, and it lacks any kind of euphoric phase. If you consume enough CBD, you will get to the point where you feel the effects. It's like if you drink too much Nyquil. One shot of Nyquil's not going to do anything to you, but if you drank a whole bottle of it and then just stood there and forced yourself to be awake, you would deeply regret it.*

This respondent could not apply the intended distinction to his own experience because he knew too much about the precise chemical effects of CBD and THC. Nevertheless, there was no response error because he understood the purpose of the distinction and correctly reported his medical marijuana use to the item referencing the "kind of cannabis intended to get [him] 'high.'"

Effects of question order on potential response error

During this study, the CCQDER interviewing team noticed two instances of unexpected product misclassification despite respondent comprehension of the distinction between products intended or not intended to get the user high. In the beginning, the team asked the question on CBD product use – that is, the kind of cannabis product not intended to get the user "high" – first, then two follow-up questions, and finally a longer set of questions about marijuana products – that is, the kind of cannabis product intended to get the user high.

In interviews where this question order was used, two respondents included psychoactive marijuana products with no relationship to hemp-derived CBD products when answering questions about CBD products, the "kind of cannabis that is not intended to get [them] 'high,'" One respondent included a psychoactive THC-based tincture when answering follow-up questions on modes of CBD product use and CBD product acquisition. Another respondent heard the term "cannabis" and immediately thought of her daily use of psychoactive cannabis – marijuana – which she used to "calm [her] nerves down." Thus, she answered "30 days." However, in probing, she explained that:

> *Respondent: That answer for the 30 days for CBD products is not correct. Because I rather do the THC. With the CBD when I tried it, it didn't do anything. It's not strong enough to calm my nerves…I think that my understanding was confusion. So it's more of the cannabis…*
>
> Interviewer: Because it said cannabis products?
>
> *Respondent: Right.*

> Interviewer: Do you think that it would have helped if we had asked first about marijuana products, the kind intended to get you "high," that it would have helped?
>
> *Respondent: Yes. So cannabis is like a family with both CBD and THC under it. Okay, now I get it.*

Though the respondent understood that her CBD products are not intended to – and indeed do not – get her high, she nonetheless included her psychoactive cannabis products in her answer. The respondent corrected her answer to zero days. In doing so, she illustrated that it may have made more sense to ask about the products *intended* to get a user "high," followed by those *not intended* to get a user "high."

To investigate this potential order effect, the team decided to reorder the instrument to see if classification improved. In the revised instrument, all questions related to CBD products were moved after the questions about marijuana. Still, one respondent exhibited classification errors in the opposite direction: including non-psychoactive cannabis – CBD products – in response to the question about the "kind of cannabis that is intended to get [the user] 'high,'" the first question she was asked.

> Interviewer: During the past 30 days, on how many days did you use marijuana?
>
> *Respondent: I use CBD.* [Interviewer repeated the question] *I would say maybe about 10 times?*

The respondent also answered "10 days" to the question about CBD products and clarified during probing that she had used a delta-8 THC product once in the past 30 days.

Response patterns and interpretations for respondents who never or formerly used cannabis

Among respondents who had never used cannabis products or who had not used cannabis products within the 30 days prior to their interview, CCQDER found no evidence of response error to the two main questions on psychoactive and non-psychoactive cannabis use. Compared to respondents who currently use marijuana or CBD products, non-current product users in this study tended to associate more stigma with marijuana use and to exhibit more confusion about product types and their composition. Additionally, respondents who had used marijuana in the 12 months, but not in the 30 days prior to their interview generally understood the items in similar ways to respondents who currently use cannabis. Lack of response error to these items suggests that they may not be prone to misreporting in sporadic, former, or non-using subgroups.

The dominant reactions to the items among respondents who had not used cannabis ever or in the 12 months prior to their interview were stigma and confusion. Two respondents in this study had never used any type of cannabis. Both closely associated marijuana with illicit activity, compared to CBD products, which they associated with therapeutic or medical purposes. As one respondent put it,

> *Marijuana, to me, it's still that social illegal substance. So, you go find your dealer and you get your baggy of however many ounces or whatever. I'm pretty sure that [state] is changing its definition to allow for medical marijuana, and I don't know when that happens…I haven't quite shifted to the mindset of marijuana use is okay in certain situations or with certain permissions, or a doctor's permission or whatever. So, marijuana for me is still that illicit drug.*

This respondent then explained that her extended family members have used CBD "gummies" for stress reduction without getting a high effect, "more of a medicinal thing." Similarly, the other respondent who had never used marijuana explained that:

> *When I think of CBD products, they can potentially add value to somebody's life. Whereas I think it goes the other way with marijuana, you know, products that get you high. So, one is value add, and the other is value negative. One is therapeutic, whereas the other one is a detriment.*

Both respondents were confused about whether medical marijuana should be included as psychoactive cannabis. Respondents who had more recently used cannabis products exhibited more knowledge of product composition and effects. Nonetheless, there was no evidence of response error. While respondents were not always sure what cannabis products were, they were certain they had never used them.

Infrequent cannabis users – that is, those who used cannabis products between 30 days and 12 months before their interview – were knowledgeable about current product types and composition. For example, one infrequent user happened to be on a 30-day "tolerance break" but was "interested in the THC level" when he purchased products. Another infrequent user explained that she "always veered more toward that THC with its more mental, or 'head high,' they call it – versus body high," which she associated with CBD. This population categorized products as psychoactive or non-psychoactive in similar ways to respondents who more regularly currently use cannabis products.

Recall patterns for questions with reference periods

Several questions in this instrument contain reference periods instructing respondents to consider specific timeframes when answering. When reference periods were short and the question inquired about activity happening within the defined reference period, respondents exhibited little difficulty recalling information and using the reference period. When reference periods were long, respondents had difficulty consistently recalling the indicated behavior or activity, although there was little evidence of response error. Finally, when reference periods were short and the question inquired about activity that began prior to the indicated reference period, respondents found the item difficult to answer and inconsistently used the stated reference period to do so.

Short reference periods, defined activities

Some questions in this instrument used a short reference period – the past 30 days – and asked about specific activity during that period. Examples of these questions include:

> During the past 30 days, on how many days did you use CBD products?
>
> During the past 30 days, have you driven a vehicle while high from marijuana use?

Respondents found these questions straightforward to answer and differentiated activities occurring within the reference period from those outside the reference period. For example, one respondent said that she had not driven while high in the past 30 days but she had "before, not in the last 30 days…in the last 30 days I haven't because I've gotten in the habit of just smoking before going to bed." Another respondent explained that she had not used marijuana in the past 30 days, "but I have in the past 6 months for sure…for the past 30 days I just take a break. Once in a while, I just stop doing it for a time." For these items, there were no indications of response error due to recall.

Long reference periods, defined activities

Questions with longer reference periods, such as those referencing activities taking place in the prior 12 months, presented more challenges for respondent recall. Examples of these include:

> In the past 12 months, has a health professional, such as a doctor, nurse, or mental health professional, asked you about your marijuana use?
>
> In the past 12 months, did you seek help for adverse or negative health effects caused by marijuana at any of these places?

For example, when responding to questions about interactions with health care professionals in the past 12 months, some respondents did not include all visits to health care professionals in that period, either because they understood the question to refer to primary care providers or because they did not recall these visits without interviewer

prompting. When the activity seemed particularly severe, as in the question about seeking medical help for the adverse effects of marijuana use from emergency departments, poison control centers, or addiction treatment facilities, there was no indication of response error, as – if applicable – respondents could clearly recall when and where they sought help for marijuana-related negative effects.

Short reference periods, activity outside of reference period

Finally, a few questions in this instrument contained short reference periods – the past 30 days – but inquired about activity not directly related to the past 30 days:

> In the past 30 days, how did you get the CBD products you use?
>
> In the past 30 days, how did you get the marijuana products you use?
>
> When you used marijuana in the past 30 days, did you try to replace your use of any of the following substances? Please include only substances that you began replacing within the past 30 days.

These questions were prone to response error, as respondents included activities outside the reference period that seemed – to them – in scope for the question. For example, when answering the question about CBD product acquisition, one respondent included lotion she had received prior to the past 30 days but only began trying during the reference period. Another respondent included CBD powder she had purchased, but in probing, she explained that it had been "about a year" since she ordered any: "I got a package of about 30 doses and that lasts me for years, so. I don't use it all that often…I was using what I already had on hand." Responses like these indicate that respondents may use the reference period to identify which products they *used* in the past 30 days, not which products they *obtained* in the past 30 days, as the question wording is unclear.

Similarly, when responding to the question about replacing other substances with marijuana, many respondents included substances they began replacing outside the reference period, or, at least, the time frame of replacement was ambiguous. For example, one respondent who replaced his use of tobacco and prescription pain medication explained that, for tobacco, "I used to smoke, but I don't smoke anymore," leaving the time frame ambiguous but implying that it was not within the prior 30 days; for prescription pain medication, he explained that he did use marijuana to replace his opioid dose, so successfully that he hadn't "taken pain medication in 30 days." Another respondent considered his past use of alcohol:

> *I used to be a bit of a binge drinker. I would drink excessively on weekends. I worked shift work for 26 years, so I would work a weekend, off a weekend, nights, days, back and forth every 28 days. Sometimes, when you've worked 28 nights and you're off a weekend, you need something to do at night, and you drink…but marijuana would not help me drink as much…I found that if I would smoke a little, it would take the alcohol craving away.*

Upon probing, though, the respondent thought more about the question and said, "I haven't had an issue with drinking in several years." For these and other respondents who use marijuana to cut back on or stop using other substances, the act of replacement is ongoing. These respondents are always using marijuana in place of a different substance, and the reference period of 30 days was not applicable to their experiences.

Recall patterns for questions about frequency of activities

Questions asking about specific frequency of activities, such as questions asking about the number of days out of the prior 30 on which the respondent used CBD or marijuana products or questions asking about the frequency of respondents seeing marijuana-related advertising, produced three patterns of recall. Respondents who answered either "never" or "always," or, for questions asking an open-ended number of days, "0" or "30," found recall simple: either they could point to a daily use pattern or other experience, or they could point to never using products or never seeing the phenomenon of interest. More than one respondent, for example, referred to a "daily routine" of marijuana use or said they saw marijuana-related advertising "literally every day."

Respondents who answered options between "never" and "always" or "0" and "30" appeared less certain of their answers and used various recall strategies. For example, some respondents counted discrete incidents – "I remember using my lotion two times when I was feeling pain in my wrist" – or patterned activities that they associated with the phenomenon of interest:

> *So during the week I'll work out like two, three times. And after that I'll take CBD gummies. After you work out it's like relaxation. And sometimes you're kind of sore and it can help with being sore…I never mix my CBD with THC. I do that [CBD] during the week. The weekend are my cheat days. When Monday comes, I'm right back to working out.*

> *You cannot throw a rock in [city] without hitting a dispensary…it's like, every time I go to the grocery store I drive by at least two dispensaries.*

For questions about product use, some respondents considered their normal patterns over a week and extrapolated to a month or started with a baseline of either daily use or no use and modified as necessary. For example, one respondent who answered "28" days estimated that he used marijuana "pretty much every single day. Maybe a day give or take that I won't…Easter, you don't hang around with family smoking." Similarly, another respondent knew he used marijuana medically rarely and estimated two days over the month, though in probing he thought he may have used marijuana more often, maybe "three, maybe four [days]. It wasn't more than that." Aside from this last respondent, who may have underreported his use, there was little evidence of response error in how respondents calculated the number of days reported, and no respondents reported difficulty with recall or estimation. Similarly, no respondents reported difficulty with estimation when answering questions about the frequency of seeing advertising, although some respondents referred to "times" rather than "days" when answering.

Potential overreporting of purchasing activity

Two items in this instrument, relating to acquisition of CBD or marijuana products, were unclear to respondents and vulnerable to potential overreporting. These questions were select-all-that-apply, and, among various response options, several response options did not function as mutually exclusive. In particular, some respondents who chose "Buy it from a medical or retail dispensary" (or, for the question on CBD products, "Buy it from a smoke shop, grocery store, gas station, mall, or other convenience store") and "Have it delivered to you" referred to the same product acquisition with two (or three) response options. For a few of these respondents, choosing these two options reflected their understanding of multiple aspects of their experience. For example, one respondent who purchased CBD products at a major health and nutrition chain chose both "Buy it from a smoke shop, grocery store, gas station, mall, or other convenience store" and "Have it delivered to you" – the latter because he used an app-based delivery service. For this respondent, the first option reflected the store from which he ordered, while the second reflected the mode of delivery or acquisition. Similarly, one respondent who answered both "Get it for free or share someone else's" and "Grow it yourself at home or have someone grow it for you" had not actually grown it herself or directly requested someone to grow it for her. Rather, she knew people who grew marijuana, and they often give her some product. In this instance, the respondent was uncertain whether to report the source of the product – she knew the people who grew it – or the mode of acquisition – getting marijuana product for free.

Because of the non-exclusive response options, respondents had to subjectively determine what the intent of the question was, leading to confusion. One respondent hesitated upon answering the question about marijuana acquisition and explained "It seems like it's going back to what we already discussed. I've gotten it delivered. I've gotten it picked up from a place that's supposed to be safe. So, it's the same question." Other respondents understood that the options presented were vague: one respondent, upon hearing "Have it delivered to you," asked "Now, question. For the delivery, is that in regards from the medical dispensary?" After the interviewer read the parenthetical text, the respondent said, "Okay, so that would be a no then. From the medical dispensary, yes, But not just from a website." This respondent *excluded* her delivery service because the deliveries came from the dispensary where she sometimes picked up her product in person.

CONCLUSION

This cognitive interview study evaluated the performance of several cannabis-related survey items intended to capture respondents' uses and experiences with a variety of products. Through cognitive interviewing methods, this study examined how survey respondents understand questions on cannabis use in the context of a rapidly changing legal and regulatory environment. It identified that plain-language wording around products intended and not intended to get the respondent "high" assisted in clarifying that respondents should distinguish between cannabis products based on their psychoactive properties, rather than their legal status, purpose, or origin. Importantly, respondents who never used cannabis products or who may be unfamiliar with the diversity of products on the market at the time of this study understood the psychoactive/non-psychoactive distinction in similar ways to regular consumers of cannabis products, indicating that these questions may perform well in a larger sample. These findings can assist survey designers in focusing respondents on the desired products of interest and, for surveillance purposes, can contribute to developing measurable statistics on marijuana use.

These findings are particularly valuable for data users when these items are eventually fielded on national or state-level surveys. Through item-by-item evaluation of how survey respondents interpret and respond to questions, data users can consider the potential for measurement error and recognize patterns in the data across subgroups. This is especially important when data are used to assess trends over time or to inform public health interventions.

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Appendix 1: Question-by-Question Analysis

CBD: *The next question asks about CBD products, that is, cannabis products that are not intended to get you "high." These products are generally derived from hemp. Do not count cannabis products that are intended to get you "high" when answering this question.*

During the past 30 days, on how many days did you use CBD products?

[# 0-30]

For the rest of the survey, we will refer to these types of cannabis products as "CBD products."

Nearly all respondents to this question only included cannabis products with low to no THC content. Respondents knew these products were CBD products by two cues: purpose and effects. In this study, respondents often identified their CBD products by pointing to the specific ailment, condition, or issue they sought to address and identified the effects they felt. For example, one respondent who only used CBD products explained that she uses it to address pain and aches from "physical hard stuff" on her farm. She described her understanding of how the CBD products helped her:

> *The CBD helps me sleep. It helps me exhale and rest. And I still have a lot of discomfort and pain in my knees and I also have some nerve damage in my left hand, and it helps with that. I'm not looking for anything to give me a buzz. I'm just looking for something to take the edge off, to help me sleep at night.*

Another respondent, a former user of both psychoactive and non-psychoactive cannabis products, also used CBD products:

> *I was having some muscle strain issues and had done a little bit of investigation and supposedly, it was supposed to help with the pain and give it enough relaxation so that the muscle could heal itself, or the nerves or whatever it was that was bothering me.*

However, this respondent felt that the CBD product had no effect – "it wasn't really helping" – and discontinued use. A final respondent used CBD for her anxiety – to combat what she called the "Sunday Scaries," that feeling of dreading going back to work after the weekend, as well as other times she feels anxious. For this respondent, the lack of psychoactive effect was crucial:

> *I don't want to get high. I don't want something that's going to mess up my thought processes. Especially if I'm going to be working. I want to be in control of what I'm thinking and saying…CBD gives you the calming, relaxing feelings, and marijuana products, the THC part is what gets ya high.*

Nonetheless, a few respondents in this study did identify a type of "high" associated with CBD. In their understanding, though, the type of high qualitatively differed from that of psychoactive cannabis. For example, one respondent explained that "I just found the feelings interesting. It was more of a body type of high, whereas when you smoke weed, your brain kinda gets high." Another respondent who had previously used CBD products explained that "it's not the same type of high as marijuana, but it's more of a relaxed high." Though both respondents identified a type of "high" associated with CBD, there was no evidence of response error: both respondents excluded psychoactive cannabis products when answering this item.

<u>Deciding on the number of days</u>

Strategies for recalling the number of days on which respondents had used CBD products varied depending on whether respondents reported zero days, 30 days, or somewhere in between. Those who answered "zero" days explained that either they had not used the product in the past 30 days; know that others in their family (or their

pets) use CBD products, but not them; or never tried CBD products. Those who answered "30" days referenced regular, daily use.

However, respondents answering between zero and 30 days in this study appeared to be less certain of their answers, as discussed in the Key Findings. Respondents used words like "probably," "maybe," and "at least" to describe their usage. Some respondents referenced discrete incidences, like wrist pain, or patterned activities, like gym workouts, that they associate with CBD product use, and these respondents appeared more certain of their answers. No respondent reported difficulty with recall or estimation.

Response error

One respondent included psychoactive cannabis products when answering this item. This respondent was highly motivated to provide responses on her daily psychoactive cannabis use and thought the question was referencing those products, answering "30" days. Upon probing, the respondent corrected her response to "zero" days. This respondent's experience, as well as that of another respondent who included psychoactive cannabis use in answering the next two questions, led CCQDER to modify the question order partway through the study. CCQDER placed this question, which referenced the "kind of cannabis not intended to get [the respondent] 'high,'" after the questions referencing psychoactive cannabis use. There was no incidence of response error to this question or other CBD product-related questions following this change. However, there was one instance of response error to the question on marijuana use following the change.

CBDUSE: *When you used a CBD product during the past 30 days, how did you use it? [Version 2: You can say yes or no to each one.] (Check all that apply)*

Did you:
Apply it to the skin (for example, in a lotion, gel, oil, balm, or bath salt)
Smoke it (for example, in a joint, blunt, or cigar)
Eat it or drink it, including drops, sprays, or tinctures (for example, in edibles like brownies or gummies or in capsules, or in tea, cola, or alcohol)
Vaporize it (for example, in an e-cigarette-like vaporizer or another vaporizing device)
Dab it (for example, using a dabbing rig, knife, or dab pen)
Use it some other way

Respondents understood this question to ask how they consumed or interacted with CBD products included in the preceding item and generally understood the response options consistently. Respondents indicated a wide range of products used, including lotions, balms, gummies, powders, tinctures, bath bombs, and waxes, among others. Respondents also reported smoking CBD "flower," that is, the plant itself, although no respondents in this study reported using a vaporizer in the past 30 days. Those who chose "Apply it to the skin" included roll-on balms, CBD oils, bath bombs, lotions, and ointments; those who chose "Eat it or drink it" included gummies, tinctures, and mixable powders. Respondents who used products "in some other way" included one instance of response error, discussed below, as well as one respondent who used CBD incense and one respondent who smoked CBD and used it in an unspecified way.

Response error

Two types of response error appeared for this question across both versions evaluated. First, some response error occurred because the parenthetical text was not typically read, as in the case of one respondent who included a "hand balm" under "Use it in some other way." This type of response error is notable for future use of these questions in interviewer-administered surveys. Second, one respondent included a tincture that was "mostly THC but…also has some CBD in it and it's still intended to get you high." This respondent did not include this tincture when responding to the main item on CBD product use. However, the reference to "tinctures" in this item prompted her to include a psychoactive tincture even though the tincture was not an exclusively-CBD product.

One respondent indicated an unusual way of referencing CBD product use. This respondent included CBD gummies, dabbing, smoking, and lotion, but in each of these instances, he used CBD concurrently with his psychoactive cannabis use, sometimes even mixing the products directly. For example, he mixes CBD "flower" with marijuana "flower" to amplify the "medicinal effects like anti-inflammatory [of CBD]…especially if the THC has no CBD," creating a joint with "like 16% CBD." It is not clear whether this mode of use is intended to be captured by the questions referencing CBD products.

Vocabulary issues

Several respondents were confused by the term "Dab it," and one initially thought she should include the CBD lotion she applied to her skin. In all such cases, there was no response error after the interviewer read the parenthetical text.

CBDBUY: *In the past 30 days, how did you get the CBD products you use? [Version 2: You can say yes or no to each one.] (Check all that apply)*

Do you:

a. Buy it from a medical or retail dispensary
b. Buy it from a smoke shop, grocery store, gas station, mall, or other convenience store
c. Buy it from a friend or acquaintance
d. Get it for free or share someone else's
e. Grow it yourself at home or have someone grow it for you
f. Have it delivered to you (from the internet, mail order, or delivery service)
g. Get it from somewhere else
h. I did not obtain CBD products from any source in the past 30 days.

Respondents understood this question to ask where they acquired CBD products included in the item on frequency of CBD product use, CBD.

As discussed in the Key Findings, response options in this item did not function as mutually exclusive and were thus unclear to respondents, leading to reporting of the same activity via more than one response option. This question was particularly vulnerable to overreporting between options a) and b), as option b) did not appear in the similar question on marijuana acquisition (MJBUY). Some respondents who purchased CBD products at a "smoke shop" were not sure whether to report their acquisition under "Buy it from a medical or retail dispensary." One respondent, after hearing a) read aloud, asked the interviewer, "I don't know if the vape shop would count as a dispensary, so no?" The interviewer continued to the next response option, which the respondent chose, explaining that "I feel like a dispensary, you have to have a medical marijuana card, and basically a prescription to go in." Another respondent explained that the "retail dispensary" and "smoke shop" she selected were the same business. In addition to the lack of clarity, this response pattern may also be the result of response option order. Particularly in states without legal psychoactive cannabis programs, CBD product users may obtain their products only in places like smoke shops, grocery stores, and malls. As currently ordered, respondents hear this response option after the response option referencing dispensaries.

Response error

Two additional patterns of response error emerged in evaluation of this item. First, across both versions and as discussed in the Key Findings, respondents did not always answer according to the stated reference period – the past 30 days – because they included products they used, but did not acquire, in that same period. That is, respondents answered about use of products they already had on hand, not their CBD product acquisition within the reference period. Second, in Version 1, two respondents included psychoactive cannabis products. One of these respondents included these products in all CBD-related items, while the other only included these products in CBDUSE and CBDBUY. As in the preceding items, question order may have impacted these responses, as neither respondent had yet encountered the items about psychoactive cannabis use. There was no response error after modification of question order to place the items about CBD products after the items about marijuana.

MARIJUANA: *The next set of questions ask about marijuana, that is, the kind of cannabis that is intended to get you "high," including products like delta-8 THC. During the past 30 days, on how many days did you use marijuana?*

[# 0-30]

For the rest of the survey, we will refer to these types of cannabis products as "marijuana."

Respondents understood this question to ask about their psychoactive cannabis product use in the 30 days prior to their interview. Two principal findings emerged. First, while most respondents in this study who used marijuana for medical purposes included it when answering this question, some respondents did not. These latter respondents excluded medical marijuana because they did not use it to get high but for therapeutic purposes; that is, instead of considering *product intent*, these respondents considered *their own intent*. Second, respondents who used psychoactive CBD derivatives such as delta-8 THC included these products when answering. This contrasted with the prior wording of the question, in which respondents inconsistently categorized delta-8 THC as either a "marijuana" or "hemp or CBD-only" product (1).

Inclusion of medical marijuana

Respondents who use marijuana for medical purposes may not use marijuana to get "high." Rather, medical marijuana users consider their consumption of marijuana products treatment for a condition, whether this treatment is or is not recommended by a medical professional. In this sample, most respondents who reported using marijuana for medical purposes did understand that they were using the "kind of cannabis that get[s them] 'high.'" One respondent explained how he knew what his product was:

> *I've been around a lot…if I go out and put that flower in the pipe and hit it…I'm gonna come back in the house and within a minute or two I'm going to tell I'm stoned. But I'm laying back down to go to sleep.*

Another respondent, who used marijuana in the six months prior to the interview (but answered "0 days" because of the reference period), reported that he had "chronic arthritis in both hips" and that his use of marijuana "helps to relieve pain." Similarly, one daily user of marijuana products explained:

> *I think a lot of people do use – CBD is framed as the medical compound and THC being the recreational one. I don't get that. Because when you get into cancer and nausea, massive doses of THC will help you quite a bit.*

The gummies he uses, he said, "get me nice and relaxed and make my body melt a little bit. I don't have my back hurting, or my hands. But I am also high off of that." These respondents understood the distinction in the questionnaire to be about marijuana's psychoactive effects. They recognized that regardless of respondents' intended use, the therapeutic effects respondents experienced were due to the psychoactive effect of medical marijuana.

Nonetheless, though the question specifies *product* intent rather than *respondent* intent, some respondents still excluded marijuana used for medical purposes when answering the item. For example, one respondent answered "zero days" to this question. During probing, the respondent explained that she intermittently used marijuana to treat "spinal stenosis." However, she excluded this marijuana use from answering the question because, first, the marijuana use had occurred outside the 30-day reference period, and second, because she did not "smoke to get high." While there was no response error – only because of the 30-day reference period – the respondent still understood the question to ask about *her intent* for product use, rather than the product's psychoactive effects. Indeed, this respondent also did not classify her medical marijuana as a CBD product, indicating that for her, medical marijuana was neither cannabis "intended to get [her] 'high'" nor cannabis "not intended to get [her] 'high.'"

Similarly, another respondent, who had used marijuana for non-medical purposes several decades earlier, explained that she understood that marijuana could be used for medical or recreational purposes. But, she said, "when I think of medical marijuana, I assume that medical marijuana doesn't get you high." To the extent that this pattern of interpretation is present among respondents who use marijuana exclusively for medical purposes, it could lead to measurement error: underreporting marijuana use. In this sample, though, most respondents who excluded use of medical marijuana were former marijuana users or people who had never used a cannabis product, a population potentially having incomplete information on the effects of medical marijuana. Further research may be helpful to identify whether respondents who specifically use marijuana for medical purposes generally include or exclude such use when answering this question, and, consequently, whether revisions to this item are necessary to minimize the risk of underreporting.

Inclusion of psychoactive hemp-derived products, such as delta-8 THC

All respondents in this study who had used delta-8 THC or other psychoactive CBD derivatives included these as marijuana products – that is, the "kind of cannabis that is intended to get you 'high.'" For example, one daily user of marijuana, who vapes delta-8 THC, explained that he doesn't use CBD products "as a rule." In doing so, he categorized delta-8 THC – despite its derivation from hemp – alongside his use of more traditional "pot," which he dabs and smokes. As he explained, "it's a little different [from traditional marijuana]. When you're out of [legal state] weed, you pull out the old standby you can get right down the street at the convenience store." Another respondent, who used psychoactive cannabis daily and CBD products 10 out of the preceding 30 days, also reported using delta-8 THC under the question referencing marijuana. To the question on CBD products, this respondent explained that he would mix CBD products with traditional marijuana to mitigate the effects of THC and to provide what he called "anti-inflammatory" effects. Like the previous respondent, this respondent excluded his delta-8 THC use from the question on CBD product use.

Even respondents who felt fewer effects from delta-8 THC than standard marijuana products (that is, delta-9 THC) included it as a "kind of cannabis that is intended to get [them] high." One respondent who used standard marijuana products in the prior 30 days but had used delta-8 THC products in the past explained that, in answering this item, she "would include everything else except for the CBDs…And it depends, like the delta-8 has less of an effect…as far as pain and movement." Though this respondent went on to clarify that with delta-8, she "didn't get high…didn't get the munchies…it didn't do anything for head relief," she understood that the intent of the product was to get her high, which the respondent hoped would also include pain reduction.

Most respondents in this study, when prompted, had not heard of delta-8 THC. Nonetheless, there was no evidence of response error: respondents who had used only delta-9 THC products referenced those products, while respondents who had used only CBD products or not used marijuana in the prior 30 days answered "zero" days.

Calculating the number of days

As discussed in the Key Findings, strategies for recalling the number of days on which respondents had used marijuana varied depending on whether respondents reported zero days, 30 days, or somewhere in between. Those who answered "zero" or "30" days found the question straightforward, while respondents who answered between zero and 30 days drew on several strategies to approximate their usage: considering their normal pattern over a week and extrapolating to a month, counting specific episodes, or starting with either daily use or no use and modifying as necessary. In particular, respondents who used marijuana for medical purposes could provide a detailed picture of their daily or more-than-daily use.

One respondent who more regularly used marijuana knew that he had not used marijuana in the preceding 30 days because he was on a "30- to 60-" day break to improve his tolerance. In this case, the question functioned as literally written – use of marijuana in the prior 30 days – but did not capture a respondent's regular use of marijuana.

Response error: inclusion of non-psychoactive CBD products

One respondent interviewed after the change to question order placing this item first in the instrument initially responded to this item by saying, "I use CBD." When the interviewer repeated the question, the respondent answered "10" days but, upon probing, explained that she had included nine days on which she used a CBD-only product, as well as one day in which she used a psychoactive delta-8 THC product.

MJBUY: *In the past 30 days, how did you get the marijuana you use? [Version 2: You can say yes or no to each one.]*

Did you:
a. buy it from a medical or retail dispensary
b. buy it from a grocery store, gas station, mall, or other convenience store
c. buy it from a dealer (in person) or friend
d. get it for free or share someone else's
e. grow it yourself at home or have someone grow it for you
f. have it delivered to you (from the internet, mail order, or delivery service)
g. get it from somewhere else
h. I did not obtain marijuana from any source in the past 30 days.

Respondents understood this question to ask about where they acquired their psychoactive cannabis. Respondents who used delta-8 THC and other hemp-derived psychoactive products included acquiring these products in answering this item. For example, both respondents who answered "buy it from a grocery store, gas station, mall, or other convenience store" cited their delta-8 THC purchases. One explained that he had "bought some from a gas station…They have like, you know, the delta-8, -9, -10, or the THC-A or the HHC. Either in the flower form or the vapes." Inclusion of these psychoactive cannabis products suggests that the definition of "marijuana" provided in MARIJUANA carried over to this item.

Potential overreporting: inclusion of in-person and online acquisition

Response options in this item did not function as mutually exclusive and were unclear to respondents, as discussed in the Key Findings. Respondents reported the same product acquisition via more than one response option, especially answering both "Buy it from a retail or medical dispensary" and "Have it delivered to you."

Potential response error

There were minimal additional instances of potential response error to this item. One respondent included a product that would not, by itself, get him high, but that was intended to be transformed into a psychoactive product. This respondent bought "THC-A" online. As he explained it, "this THC-A material is, by definition, not the THC that is regulated as a controlled substance. It needs to be heated up to a certain temperature to become the delta-9 THC that gets you high." Because this respondent knew his derivation of the product had psychoactive effects and that these effects were the intended use of the product, he included it in his response.

COUSE: *When you used marijuana in the past 30 days, did you use any other substances at the same time or within a few hours? [Version 2: You can say yes or no to each one.] (Select all that apply)*
a. A tobacco or nicotine product like a cigarette, cigar, blunt, or vape
Alcohol
Prescription medications, including opioids taken as directed by your doctor
Prescription opioids not prescribed to you or not used as directed by your doctor
Psychedelics, such as LSD, acid, or mushrooms
Other drugs, including heroin or illicit fentanyl
I did not use marijuana with other substances

Respondents in this study understood this question to ask about any use of a substance alongside marijuana, regardless of intent. While intentional co-use to amplify or modify the effects of marijuana or the co-used substance was sometimes particularly salient, no respondents excluded their incidental use of substances alongside marijuana.

Some respondents discussed intentional and purposeful co-use, whether in products that contain multiple substances, like blunts, or by pointing to the specific effects of each substance. For example, one respondent explained that in smoking a blunt, "you split it in half, throw out the tobacco [and put in marijuana], and seal it up, and then smoke it." Another respondent explained that when he takes mushrooms "while medicating with THC, it's more so to microdose the shrooms. And not get the full-fledged hallucinogenic aspect of it." Nonetheless, this latter respondent included incidental co-use of tobacco as well. Respondents who used prescription medications at the direction of a doctor only discussed amplification of effects when the prescription medication had the same goal as the marijuana use, such as pain reduction, but otherwise included these medications even if they had no relationship to their marijuana use.

More commonly, respondents reported incidental co-use only, particularly with legal substances such as tobacco, alcohol, and prescription medications. For example, one respondent, who answered "Alcohol," said that "Yes, I do drink alcohol, and so it happens that I drink alcohol and I use my marijuana, and it so happens that I am using it at the same time." Another respondent, who answered, "A tobacco or nicotine product" and "Alcohol" similarly said that "Yeah, I often have marijuana and cigarettes at the same time. I'm not like, oh, let me put the cigarettes down because I am about to smoke some weed, or I'm taking this gummy." Because the question wording does not specify whether co-use should be purposeful or should also include non-purposeful, incidental use of other substances, respondents are left to make their own judgments of what experiences to include.

Potential and actual response error

Some respondents appeared deterred from reporting their prescription medication use because of the example of (on-label use of) prescription opioids. For example, one respondent asked "Would other medications count as that? Like if it were a non-narcotic medicine?" In the end, this respondent decided to report the prescription medications he used "for sleep or calming" even though he was careful to specify that "I don't take any kind of opiates." Another respondent initially did not report his use of a pain medication, gabapentin, but it was not clear that this was the result of response option wording. However, this pattern was certainly not universal: many respondents reported various types of medications, including for mental health, pain management, seizures, and heart health, without issue. Importantly, respondents who used opioids at the direction of their doctor included these, as in the case of one medical-use respondent who explained "I have been lowering the dosage of [the opioid] with the medical marijuana. Once I'm on a good dose of [the marijuana] I'm going to lower the dose of my meds and then go off of them."

One respondent appeared to answer not about co-use of a substance but avoidance of substances. For example, this respondent answered "Alcohol," but when probing, she explained that:

> *Respondent: …alcohol and marijuana together is not always a good idea. So, if I'm drinking, I probably won't indulge in marijuana because I'm already drinking. Those are two things that I try not to do at the same time, that I'm more conscious of.*
>
> Interviewer: Is it possible that you might have some alcohol within a few hours of having marijuana?
>
> *Respondent: No. Because if I take a gummy or smoke some weed, I probably won't even want to drink alcohol. And if I'm already drinking, I'm thinking let me not take this gummy or eat this cookie.*

Interestingly, the respondent also reported "A tobacco product" and described at length her use pattern with cigarettes, indicating she considered both co-use and avoidance when answering the question. Because this respondent was probed retrospectively, it is also possible that the next item, REPLACE, influenced how she explained her answer.

One respondent thought the question referred to direct combination of marijuana and other substances in one product. This respondent, upon hearing the question, initially said, "What it consists of? Uh, marijuana…not adding

anything else but regular marijuana." When the interviewer repeated the question, the respondent said "Oh, I see what you're saying. Yes, I have done that [drank alcohol]…just having a sociable drink."

One respondent initially did not report his use of methamphetamine and only answered "Alcohol." Upon probing, he said, "Now, sometimes somebody will whip out a meth pipe and pass it around," and reflected that this had occurred in the past 30 days. This respondent thought that methamphetamine would be best reported under "Other drugs," but did not initially report this because smoking methamphetamine was not his original goal nor his own product. Instead, he revealed his co-use after rapport with the interviewer had already been established. This may suggest the potential for underreporting of substances like methamphetamine due to social desirability bias.

No instances of response error occurred because of changes to the question instructions or question order between versions.

REPLACE: *When you used marijuana in the past 30 days, did you try to replace your use of any of the following substances? Please include only substances that you began replacing within the past 30 days. [Version 2: You can say yes or no to each one.] (Select all that apply)*

a. A tobacco or nicotine product like a cigarette, cigar, blunt, or vape
Alcohol
Prescription medications, including opioids taken as directed by your doctor
Prescription opioids not prescribed to you or not used as directed by your doctor
Psychedelics, such as LSD, acid, or mushrooms
Other drugs, including heroin or illicit fentanyl
I did not replace my use of other substances with marijuana

This question captured two mutually exclusive question interpretations due to unclear question wording. Some respondents understood the question to ask about which substances they replaced with marijuana, that is, using marijuana instead of using alcohol, tobacco, prescription medications, or another substance. Other respondents, however, understood the question in the opposite way: that is, they thought about which substances they used *instead of marijuana*. Conflicting interpretations have the potential to limit the utility of this item.

Replacement and reverse replacement

Some respondents understood this item to ask about instances when respondents began using marijuana instead of other substances. For example, one respondent who reported using marijuana to replace his use of prescription opioids explained that:

> *I was taking a lot of pain medication, and I didn't want to take the pain medication no more. The more pain I was in, the more my doctor prescribed a higher dose. I didn't want to take a higher dose, so I chose THC, and that dealt with the pain sufficiently enough.*

Another respondent said that he uses marijuana to cut back on vaping tobacco. When he thinks about vaping tobacco, "then that's when I'll go and pack a bowl. And once I smoke that bowl, then I won't have an urge to vape." Even some respondents who said they did not replace other substances with marijuana understood the item in this way, as in the case of one respondent who used prescription medications alongside marijuana:

> *I think for me…it was more…I wasn't replacing anything with it. It was just trying it out, and then enjoying it, and then realizing that it helped me…for me, I have to stay on my meds. Because I had it where I was off for like a week because I ran out, and I can tell that the weed does not make up for the medication. I need my Prozac and my Adderall to function…I do meds and smoke, and I'm okay with that.*

However, several respondents understood the item to ask about instances when they used other substances instead of using marijuana. One respondent asked if the question meant, "I drank so I wouldn't smoke weed?" Another thought the question meant "did I try to, uh, stop using marijuana and replace it with something else, like with different tobacco or fentanyl or opioids." Both respondents answered, "I did not replace my use of marijuana with

other substances," which may or may not have been response error. However, some respondents reported replacing marijuana with substances including tobacco and alcohol. One respondent explained that he thought the question was asking "[if] you don't have any weed to smoke, what do you do? That would be my substitute if I can't get weed. I'll drink some alcohol or drink some beer or chain smoke." Importantly, this respondent did not use marijuana to cut back on his use of any other substance.

For some respondents, even deciding on an interpretation – deciphering the question wording – was challenging. One respondent, who appeared to think about co-use, not replacement, initially answered "alcohol" and explained that "I'll use alcohol, like, on special occasions. I'm not really a drinker…I do drink, so I'll say yes." Another heard "I did not replace my use of marijuana with other substances" and slowly repeated the response option: "No, I did not replace?...I did not replace my use…I have not replaced any of my medications with marijuana." The potential for replacement in either direction – a substance with marijuana, or marijuana with a substance – may have contributed to respondent confusion.

No instances of response error occurred because of changes to the question instructions or question order between versions.

Reference period

As noted in the Key Findings, respondents inconsistently adhered to the reference period specified in the question, and it seemed challenging for respondents to identify replacement that began within the prior 30 days. Rather, many respondents appeared to consider ongoing replacement that may have begun earlier and found the reference period of 30 days inapplicable to their experiences.

DRIVING: *During the past 30 days, have you driven a vehicle while high from marijuana use?*

a. Yes
No

In this study, respondents focused on the phrase "while high" and, almost without exception, considered only situations in which they felt the psychoactive effects of marijuana. However, one respondent included times when she did not feel any psychoactive effects when answering this question. Thus, though most respondents in this study consistently understood "while high" to refer to the psychoactive effects of marijuana when answering this question, the potential for broader interpretation can lead to inconsistent response processes and measurement error. Respondents who understood "while high" to refer to psychoactive effects differed in whether they considered being high to always, sometimes, or never constitute impairment.

A small group of respondents do not drive and answered "No" because the question was irrelevant to them.

Being high versus being impaired

Some respondents associated being high with being impaired. For these respondents, recent ingestion of marijuana was enough for them to recognize diminished driving ability. For most of these respondents, that was also enough to keep them from driving a vehicle; that is, nearly all of these respondents answered "No." Respondents used different strategies to gauge when they were safe to drive. For example, one respondent explained that he'd "driven drunk probably 3,000 times," but for marijuana use,

> *the routine that my wife and I have settled into is, if we're going out, I'll smoke at home, and she'll drive to where we're going. And then she drinks, and I drive home. So that way, neither of us are driving under the influence. It's like 3 hours for me to wear off. I can't tell when it's worn off, but I try to avoid it.*

Another respondent also spoke about a "buffer of time," saying, "I'm very careful…If I know I'm going for a drive at 10 a.m., I won't take [marijuana], and then do my thing, and then come back and if I'm home and stuff, I'll take it." Other respondents similarly stated that they would only smoke if they knew they would remain inside for the rest of the evening.

However, not all respondents always associated being high with impairment. One respondent distinguished between different levels of being high, what he called "primary effects" and "secondary effects":

> *The primary effect is, like, I am intoxicated, you know what I mean? Like if things around the house are still distracting or goofy, it's like, you know, I shouldn't get behind the wheel of a three-thousand-pound murder device. But then the secondary effect is, okay, I'm not feeling anxious, I can focus on my homework, or whatever – that pain that I had is gone…So long as the primary effect isn't still there, the secondary effect is fine because that is kind of the medication effect I was going for anyway…Let's say you have a severe leg injury, and you're prescribed low dose opiates for it, and you take the low dose opiates, and now you are not in pain. I wouldn't call you impaired, you're back to baseline.*

While this respondent answered "No" because he stayed overnight at the place where he used marijuana, he also would have answered "No" had he only been feeling the "secondary effects" of marijuana use; that is, after the amount of time where he no longer felt "goofy." When feeling these "secondary effects," the respondent saw himself as "back to baseline," not impaired.

Some respondents even argued that marijuana did not affect their driving; that is, impairment from marijuana use was not possible. One respondent put it bluntly:

> *I smoke when I'm on the way to work. I smoke when I'm leaving work. So, I smoke when I'm driving…It doesn't affect me. It doesn't make my eyes low, like I can't see, or like I can't pay attention, nothing like that…I don't really see that marijuana impairs people. I mean, like some people can't handle it. But me personally, I'd rather someone drive high than drunk.*

Other respondents identified certain modes, strains, or quantities of marijuana use as causing impaired driving. One respondent said that he

> *won't drive anything on edible…that onset, it always affects everyone differently. So I don't want to be at a red light and boom, it hits me and gets sleepy, groggy, and can't function. Versus flower-wise, if I were to smoke a joint, and then I'm going to the grocery store, and I'm completely fine or self-aware of what's going on.*

For some respondents, the length of the drive also mattered: one respondent explained that she sometimes drives while high, but only to "places that [she is] very familiar with," such as her local grocery store, about three miles away.

Considering drug test results

One respondent understood the question differently. This respondent's typical use pattern was smoking marijuana in the evening, sleeping, and driving to work the next day. She answered "Yes" because to her, the marijuana was still in her system:

> *Respondent: it's not that I'm driving erratic, but it's still in your system. So high, to me, is because you still have it in your system.*
>
> Interviewer: Like you would test positive?
>
> *Respondent: Yes! Yes!*

The presence of this pattern indicates that "while high" may not always refer to psychoactive effects, at least in the context of operating a vehicle.

Social desirability bias

Social desirability bias arises when survey respondents overreport what they judge to be socially positive behaviors and underreport what they judge to be socially negative behaviors. Little evidence of social desirability bias was found when evaluating the older version of this item, a pattern that continued in this round of evaluation despite the revised wording "driven a vehicle while high" (1). Respondents seemed willing to share not only that they had driven while high but also their specific experiences and the relative frequency of their driving. For example, one respondent said that he "used to drive a motorcycle impaired…I would definitely get high before I would get on the bike." This respondent identified being high as being "impaired," but this did not impact his decision-making to drive a motorcycle. In fact, he was comfortable disclosing that information to the interviewer. No respondent reported any hesitancy at answering the item, and, in contrast to the earlier evaluation, no respondent reported that this was a "loaded" question. It is possible that the wording "while high," by removing the phrase "affected by" and avoiding the term "impaired," allows respondents to report their driving without as much implied stigma.

HPASK: *In the past 12 months, has a health professional, such as a doctor, nurse, or mental health professional, asked you about your marijuana use? Do not include office intake forms completed prior to an appointment.*

a. Yes
b. No
c. I haven't seen a health professional in the past 12 months

In this study, respondents' question interpretations primarily varied on their conception of an "ask." When answering this question, some respondents in this study included only direct conversations with and initiated by health professionals, while others included both these direct conversations and simpler "Do you use…?" inquiries. In the context of this variation, respondents also did not consistently follow the instruction to exclude intake forms and did not always include non-primary care health professionals.

Understanding of "asked you about your marijuana use"

All respondents included direct and verbal inquiry from a health professional about marijuana use when answering this question. One respondent, upon hearing the question, provided a typical narrative:

> *I have seen a health professional, and it was an intake, but it wasn't before the visit. I already filled out the intake, but it was actually the doctor asking me the questions. She was asking me do I drink on the regular, do I smoke, what do I use, what medications and stuff like that.*

However, when the inquiry was indirect or did not lead to sustained engagement, some respondents excluded it from consideration. For example, one respondent, who answered "No," explained that he sees "a therapist for bipolar disorder…and I take lots of medication for it. And [the doctor] knows that I smoke marijuana, but they don't seem to care at all." Because this respondent's therapist does not discuss marijuana use with him, the respondent excluded the encounter from consideration. Another respondent, who also answered "No," said that "it's come up in the screening process. When you register, they ask me, do I use marijuana. I tell them yes." Because his doctor does not follow up with him, the respondent answered "No." Similarly, respondents did not always include the question "Do you smoke?", which they considered vague, as an explicit ask:

> *Sometimes they ask, do you smoke. They don't use the word marijuana. They just ask, do you smoke? I tell them I don't smoke cigarettes. Because I don't know if they mean cigarettes, or you have to get direct with me, because I'm not doing a lot of sharing if it's not necessary.*

Respondents also did not always include conversations that they themselves initiated with health professionals. For example, one respondent who uses marijuana for medical purposes answered "No," even though she had spoken with a "pain management doctor" about marijuana use. She explained her understanding of the question:

> *They didn't ask me. That's the trick in that question. You didn't say, have you had a conversation with your health professional about marijuana use? If you had said it that way, it would have opened it up for both ways [respondent- and doctor-initiated]. But no one has asked me about my marijuana use.*

Another respondent, who also answered "No," said that she is "very honest. I'm like, look. I smoke marijuana. They were like, that's not what we were looking for [the health professional asked if she smoked]. Most of them are like, that's okay. You didn't need to tell us that. It's legal." Nonetheless, some respondents did include conversations they initiated, as in the case of one respondent who sees a therapist and felt he "had to disclose to him that I was on cannabis." This respondent answered "Yes."

Inclusion of office intake forms

Revisions to this item attempted to minimize the inclusion of office intake forms as an "ask" by instructing respondents to exclude these forms. It is not clear that these revisions were successful, because respondents' inclusion of intake forms directly related to their broader understanding of the words "asked you about" in the question. For example, one respondent answered "Yes," because she "did see a health professional in the last 12 months, and they did [ask], and I said no." In probing, however, she explained that this ask was "on a form." Another respondent also said "Yes" because "they gave me a form to fill out asking about marijuana use, narcotics, stuff like that." Respondents did not universally include intake forms, however: one respondent answered "No" even though he was asked about marijuana use on intake forms in the prior 12 months, because he was considering only instances when a health professional "asked me or brought up marijuana use."

Inclusion of non-primary care health professionals

In this study, respondents most commonly included "primary care providers" in determining their response. Additionally, the inclusion of "mental health professional" appeared to prime respondents to include encounters with their therapists or psychiatrists, and respondents who had seen physicians who could recommend medical marijuana included those visits. However, respondents did not always include all health professionals they had seen in the prior 12 months. For example, one respondent said "No" and explained that she considered two health professionals who were "licensed practicing physicians" and "alternative health practitioners," but she did not immediately include a "physical therapist" she had mentioned when answering a different item. Another respondent, who answered "No," thought about her "primary care doctor," but in probing also indicated she had seen an ear, nose, and throat specialist. Because neither practitioner asked her about marijuana use, there was no evidence of response error. One respondent, discussed below as an instance of response error, did exclude a doctor who recommended medical marijuana.

Response error

Three patterns of interpretation indicated the potential for response error to this question. First, respondents may be uncertain whether to include telemedicine encounters when answering the item. One respondent answered, "I haven't seen a health professional in the past 12 months" and excluded a telehealth visit with her OB/GYN because she was uncertain whether to count non-in person visits. Had she included the visit, she would have answered "No," because this OB/GYN did not ask her about marijuana.

Second, some respondents only understood the question to refer to primary care providers and excluded specialists closely related to marijuana use. One respondent answered "No" but explained he had discussed marijuana with his "medical marijuana doctor" recently – within the prior six months. In probing, the respondent said that he "probably just misunderstood the question" and appeared to primarily consider "primary care" providers specifically because of the reference to intake forms. This respondent's initial reaction indicates that despite the clarification to provider types – "doctor, nurse, or mental health professional" – respondents may not initially consider doctors who can recommend medical marijuana when answering.

Third, the nature of the conversation appeared to matter to some respondents. If the discussion was unrelated to the reason for seeking treatment, one respondent excluded these encounters from consideration. He explained:

> *All of my doctors are aware I consume cannabis, or consume marijuana. But none of them have spoken to me about it in any kind of professional opinion…They just wanted to know about it. They weren't interested*

in how it was impacting my condition…it's like they wanted to check in and make sure it wasn't hitting their role in this [his health conditions]…I go talk to my gastroenterologist about it and say, I'm using it to control the spasms, he's like, great, that's what it's for. But my PCP, she doesn't care because she didn't prescribe it.

When asked what he thought he would answer, he chose "No." This respondent appeared to only include his initial encounters with health professionals, not ongoing management of his conditions, and only include conversations with health professionals in which marijuana was relevant to the condition that they were treating.

No instances of response error occurred because of changes to the question order between versions.

HPADVICE: *In the past 12 months, has a health professional, such as a doctor, nurse, or therapist, done any of the following? [Version 2: You can say yes or no to each one.] (Select all that apply)*

a. Told you to cut back on or not use marijuana
b. Recommended medical marijuana or encouraged you to seek out marijuana for treatment purposes
c. Told you to change the way you use marijuana, for example, from smoking to edibles
d. Given you other advice about use of marijuana
e. They did not provide any advice about marijuana use
f. I have not seen a health professional in the past 12 months

Respondents understood this question to ask about actions their health professionals had taken regarding their marijuana use in the past 12 months. In general, respondents included the same health professionals when answering this question as they did in the preceding question, HPASK. Additionally, because the question is more specific and does not require respondents to judge what constitutes an "ask," this question performed better than HPASK; there was no evidence of response error to this item.

Some respondents provided answers to this item even though they answered "No" to HPASK. These respondents differentiated between whether a health professional "asked" them about marijuana use and whether a health professional took an action, like advising them to cut back on their use. In this interpretation of the items related to health professionals, advice from a health professional can happen in the absence of asking a patient about their use. For example, one respondent explained that she told her doctors that she smoked marijuana; because she initiated the conversation, she answered "No" to HPASK. However, this respondent answered, "Recommended medical marijuana" and "Told you to change the way you use marijuana" to this item, because her doctors advised her – in the context of her conversation about marijuana use – to consider getting a "medical card" and to never vape marijuana. Response patterns like these indicate that questions on health professionals asking about marijuana use and about the marijuana-related actions of these health professionals can be used independently depending on the constructs of interest to the researcher.

<u>Response options</u>

Respondents usually applied consistent understandings of each of the response options. Option a), "Told you to cut back on or not use marijuana," generally included advice to stop smoking because of lung or oral health. Some respondents included this alongside option c), "Told you to change the way you use marijuana," because advice they received including switching use from smoking to edibles. However, respondents did not universally answer "Told you to cut back on or not use marijuana" when considering advice to stop smoking. One respondent answered, "They did not provide any advice about marijuana use," even though her doctor told her that she should not smoke. For this respondent, the advice was not specific enough to report under this option: "She just said, hey, you shouldn't do that. So that's not specifically telling me not to."

Respondents who chose option b), "Recommended medical marijuana or encouraged you to seek out marijuana for treatment purposes," included respondents who had medical marijuana cards under state cannabis programs as well as respondents who had discussed medical marijuana with their doctors or mental health professionals even if this was not in the context of a formal recommendation. For example, one respondent who used marijuana to treat severe pain explained that after hearing that she was using marijuana gummies, her doctors "would rather have me do the

marijuana than to turn to the street drugs." For this respondent, that was enough to constitute encouragement to seek out marijuana for treatment, even though there was no card issued.

Respondents who chose option c), "Told you to change the way you use marijuana," considered both quantity, as in the case of one respondent who reported needing less marijuana after having contracted COVID-19, and mode. The latter included advice to not engage in specific modes, such as vaping or smoking, and advice on trying different products, such as tinctures or gummies. One respondent was advised to switch from marijuana to CBD for financial and health reasons, as he "was spending $2,400 per month" and "went through four pounds of weed in two weeks." However, this respondent chose "Given you other advice about use of marijuana," suggesting the advice to change cannabis type (from psychoactive to non-psychoactive) may be understood differently than mode within psychoactive cannabis itself. Additional items included under "other advice" included changing products within the same mode, such as using "more of an organic form of a leaf" when smoking, and information about side effects received as part of a medical marijuana consultation.

Respondents who chose "They did not provide any advice about marijuana use" included respondents who used marijuana but for whom the topic never came up with their doctor as well as respondents who had never used marijuana or had only used marijuana in the past.

CUTDOWN: *During the past 12 months, were you able to cut down on or stop using marijuana every time you wanted to or tried to?*

a. Yes
No
I did not want or try to cut down on or stop using marijuana
I rarely or never use marijuana

Respondents who had used marijuana – that is, those who answered "Yes," "No," or "I did not want or try to cut back on or stop using marijuana" – primarily differed in whether they understood the question to ask about only intentional reduction in use or to include unintentional reduction in use as well. Within this context, respondents answered according to their interpretation of three concepts: desire to reduce marijuana use ("wanted to"), efforts to reduce marijuana use ("tried to"), and success at reducing marijuana use ("able to"). All respondents who initially answered "No" changed their answer to "I did not want or try to cut down on or stop using marijuana" after interviewer probing.

<u>Intentional reduction in marijuana use: desire, effort, and success</u>

In this study, most respondents who had used marijuana recently and answered this item understood this question to be about intentional reduction in marijuana use because of the phrase "wanted to or tried to." However, reasons for intentionally cutting back varied. Some respondents understood the question to be about whether they considered themselves addicted to marijuana or otherwise unable to control their marijuana use. For example, one respondent, who used marijuana for medical purposes and said "Yes," but changed her answer to "I did not want or try to," explained:

> *I feel like I can stop. I don't want to be addicted to anything that controls my life. The only thing I have to take is my medication so that I can function. But I don't need weed to live or function. I can stop if I decide to. But I enjoy it, so I don't.*

Another respondent, who also answered "I did not want or try to," said that she understood the question to ask "am I dependent. Is it something that I think should be checked, or am I having problems or issues maintaining a lifestyle? Or is it hindering me…you know, is it causing more problems than it is helping. And no, it is not."

A subset of respondents in this group – all of whom answered "Yes" – were keen to explain that they felt in control of their use of marijuana. These respondents wanted to cut back or stop using (even temporarily), tried to do so, and succeeded. For example, one older respondent said that she doesn't "want nothing to have to take control. I want to be in control." A younger respondent, similarly, said that she was able to not purchase marijuana at the store even

though she has access to it. Another respondent explained that "sometimes I'll do it more and sometimes I'll do it less. I'm pretty self-governing. It's already in balance." These respondents' references to their (perceived or actual) ability to control their marijuana use indicate that they, too, understood the question to be about addiction or problematic use, and that by answering "Yes," they were signaling that their use was unproblematic.

Another group of respondents, who answered "Yes," had various intentional reasons for cutting back unrelated to addiction or problematic use. One took what he called a "tolerance break," in which he goes "at least maybe four or five days without touching any cannabis products…just to give [his] brain and body like, a reset." Another mentioned that he was fasting for about a month during the reference period and did not smoke during the day. For these respondents, any amount of intentional cutting back – even a few hours a day, or a few days a month – was enough to answer "Yes."

Intentional reduction in marijuana use: no desire, but effort and success

Some respondents, all of whom answered "Yes," did not want to cut back on or stop using marijuana but felt they had to because of cost; that is, they did not "want to" cut back but did "try to" cut back. These respondents focused on the success of their efforts to cut back on marijuana use. For example, one respondent said that "sometimes I just didn't have the funds, so I laid off," and another explained that "I always cut back when I'm broke [laughing]." One younger respondent was recently traveling out of state to a location where she could purchase marijuana for adult use. As she put it, "I didn't have trouble getting product, but there were different situations where we're trying to figure out where we're going to be. So, it was tighter on funds, so I found myself not having the same amount." These respondents also intentionally cut back on their use but did so because of financial pressures, not desire.

Unintentional reduction in marijuana use: no desire or effort, but success

A smaller group of respondents in this study answered "Yes" not because they wanted to or tried to reduce their marijuana use but because circumstances demanded that they did. These respondents pointed to being around people who did not like marijuana use, such as "a few days…of hanging out with family or traveling for work." Other respondents referenced cutting back, unintentionally, because of illness or medical procedures. These respondents neither wanted nor tried to reduce their use but answered "Yes" because they nonetheless did reduce their use.

Response error

A small number of respondents answered either "Yes" or "No" but changed their answers to "I did not want or try to cut back on or stop using marijuana" after interviewer probing. In most cases, this was because respondents interrupted the interviewer prior to hearing all response options. This response pattern suggests a response option order effect, whereby respondents choose a "Yes" or "No" response option because they do not expect a different option more suitable to their experiences, but the prevalence of this response pattern cannot be ascertained from this study sample. No instances of response error occurred because of changes to the question instructions or question order between versions.

MJLIVESWITH: *Does anyone who currently lives with you use marijuana?*

a. Yes
No
Don't know

Respondents broadly understood this item to ask about marijuana use among those with whom they cohabitate. There was no evidence of respondents including college students or children who do not live at home. Respondents included their spouses, roommates, partners, children, and parents. Additionally, some respondents mentioned their pets, but no respondent appeared to include their pets when answering, even though one dog uses "CBD drops"; this respondent excluded this use because "it's just CBD, not marijuana."

In general, respondents seemed to know whether their cohabitants used marijuana. One explained that his wife "takes two edibles a month," and another said that her son purchases marijuana from adult-use dispensaries.

Sometimes, respondents knew their cohabitants used marijuana because they used marijuana together on occasion. Respondents who knew their cohabitants did not use marijuana also pointed to various reasons, including drug testing at work or requirements of a commercial driver's license, that they knew about non-use. One respondent answered, "Don't know," because her housemate "lives in a different part of the house," she rarely interacts with her, and they do not share a living or kitchen space.

ADVERTISING: *For the next two questions, please only consider marijuana, that is, the kind of cannabis that is intended to get you "high," including products like delta-8 THC. Do not include CBD products.*

During the past 30 days, how often have you seen or heard an advertisement for marijuana products or stores or seen a marijuana storefront? (Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing like sign spinners or sandwich boards, online or cell phone advertisements, and dispensary newsletters or rewards programs.)

a. A few of the past 30 days
b. About half of the past 30 days
c. Nearly all of the past 30 days
d. I have not seen or heard marijuana product advertising in the past 30 days

Respondents tended to understand this question to ask about the extent to which they encountered visual advertisements for marijuana products, marijuana dispensaries, and psychoactive cannabis derived from hemp, such as delta-8 THC. Most, but not all, respondents excluded advertisements for CBD products when answering, and those that did include CBD products also included advertisements for psychoactive cannabis products.

Because this question references the frequency of respondents' seeing or hearing advertisements, it is important to note that the question does not measure the actual density of marijuana-related advertising in an area, or the actual number of days on which respondents saw marijuana-related advertising. Rather, question response to this item is influenced by a combination of, first, access to advertisements; second, awareness of advertisements; and third, conceptions of advertisements and marijuana products, which sometimes included content not typically considered advertising, such as local news stories. To the extent that two respondents exposed to identical quantities of marijuana-related content vary in these three factors, their responses may differ.

Access to advertisements

Respondent exposure to advertising was determined by two factors: the extent to which respondents could be reached by personalized targeting, particularly via social media, and the availability of legal marijuana in their jurisdiction. Targeted advertising was particularly noticeable on social media. For example, one respondent, who answered "Nearly all of the past 30 days," explained:

> *there are a couple of people I know that actually work at the dispensary, and I see them promoting it on social media…they promote their daily deals, specials, things like that. I know people who have, like, a pop-up shop. They promote their stuff on their page. I mean it's on social media, they have suggestions…They say suggested for you. So, it's not just in this area, I'll see things pop-up from people that are out of state. So, it's definitely promoted.*

Other respondents echoed these sentiments. One respondent, who answered "A few of the past 30 days," said that "with social media, it really depends on who you're following and what's on your page…even when you're watching YouTube an ad will come up."

Other types of advertising, including billboards, radio, and television ads, were more dependent on the legal status of marijuana in respondents' jurisdictions. For example, one respondent explained that she drives "down [street name] and [major highway], and there are tons of billboards. Even just coming off the highway coming home, there's a big billboard announcing the dispensary that's right around the corner to me." Another respondent said that she saw that her dispensary "had an ad in the movie theatre." Others mentioned radio advertisements for getting medical marijuana cards, a "local alternative newspaper," and even local news stories about marijuana greenhouses.

All these respondents lived in jurisdictions where marijuana was legal for general adult use at the time the study was conducted. Similarly, respondents in this study frequently mentioned seeing local dispensaries and being contacted by dispensary or smoke shop rewards programs, which was only possible if they lived in or near jurisdictions with legal marijuana use. As one respondent, who answered "I have not seen or heard marijuana product advertising in the past 30 days," put it, "In [his state] it's not legal down here. But we're right against [legal state], so if I go over the state bridge, I'll see an advertisement because they have dispensaries there. But in [his state] there's not a lot of advertisement. Even online I don't see it. You have to go across the bridge."

Awareness of advertisements

Responses to this item also varied depending on the individual behavior and knowledge of the respondent. Advertisements may be present in respondents' areas, but some respondents simply did not engage with advertising or appear to see it. One respondent, who answered, "I have not seen or heard marijuana product advertising in the past 30 days" and lived in a state where marijuana was recently legalized, said, "I didn't even know that marijuana was legal in [her state]." Another, who answered, "A few of the past 30 days," said she was only "very minimally" on social media, so she didn't notice any advertisements there. A third respondent explained that he had not seen any advertising because "I don't get out much, so I wouldn't be able to see those things that you're talking about. I don't leave my neighborhood."

Additionally, in this study, respondents who regularly used CBD or marijuana products seemed to report higher frequencies of encountering marijuana advertising than those who formerly or never used CBD or marijuana products. As one respondent who used both CBD and marijuana products in the past 30 days put it, "you Google something, and then you get all the links and postings." Another respondent who regularly used marijuana in the past 30 days said "I'm surrounded by billboards. They're everywhere." While this sample is not representative, this pattern may indicate that regular users of cannabis products may be particularly attuned to noticing marijuana advertising.

Conceptions of advertising and marijuana products

In answering this item, respondents included various forms of visual and audio media, including billboards, social media (including Instagram "reels" and social media "influencers"), and radio or television commercials. In addition, respondents mentioned other sources, such as local news stories, "underground newspaper" coverage and ads, dispensary newsletters, informational material from the Internet, and direct mail. Inclusion of some of these media as advertisements demonstrates that this item measures exposure to marijuana-related content – not just advertising – in respondents' lives.

Respondents who included marijuana storefronts in calculating their answer varied in the extent to which storefronts needed to advertise to be included. For example, one respondent, who answered "Nearly all of the past 30 days," said that she would only count a storefront when answering this question if a storefront had advertising outside "to direct or attract someone's eye, or draw someone's attention"; as she put it, "not all of [the dispensaries in her area] have, like, boards outside that have their specials or prices." Other respondents, however, simply explained that "you cannot throw a rock in [city] without hitting a dispensary" or "there are dispensaries on every corner." Some respondents included advertising within dispensaries for products, while others excluded advertising within dispensaries and only considered advertising they saw elsewhere.

Most respondents limited their answers to advertising for marijuana products and marijuana storefronts. However, some respondents included advertising and storefronts for CBD products as well, but in general, this inclusion was alongside, not instead of, marijuana products. For example, one respondent, who answered "A few of the past 30 days" said that she had seen advertising on "Facebook, TikTok, Instagram…for smoke shops. I've seen advertisements for delta-products. I've seen advertisements for CBD products, ointments, tabs, tinctures…patches – that's new!" This respondent included the CBD products she had seen alongside the psychoactive cannabis products – as she clarified to the interviewer, "well, delta-8 is a marijuana product." Another respondent included radio advertisements for medical marijuana in calculating her answer but also said she was "sure that [she had] driven by some CBD stores or a billboard or two for a CBD store." Only one respondent appeared to solely consider

CBD products, but this respondent answered "I have not seen or heard marijuana product advertising in the past 30 days" because she had not seen that CBD storefront within the reference period.

Response options

Respondents relied on different strategies when deciding on the frequency of seeing marijuana advertising in the past 30 days. Similar to the CBD and MARIJUANA items, in which respondents reported the number of days in the past 30 on which they had used CBD or marijuana products, respondents who had either never seen marijuana advertising or who answered "Nearly all of the past 30 days" were certain of their response; they knew what they had not seen (even never seen), or what they saw effectively daily, respectively. Those who answered "A few of the past 30 days" rarely offered a specific calculation, instead estimating based on what they believed to have seen or the level of targeted advertising available to them (for example, on social media). One respondent said "10" out of the last 30 days and clarified that "a few" would be "three to five…I just view 10 closer to five than 15." Finally, respondents who chose "About half of the past 30 days" sometimes relied on other activities to estimate the number of days. For example, one respondent explained that she goes to her (delta-8 and CBD) smoke shop "about once or twice a week," and another respondent thought of the number of times she leaves the house to drive, since there are "three [dispensaries] within a five-minute drive." In general, respondents who reported "A few" or "About half" of the days spoke of "times" – rather than "days" – they saw marijuana advertising more frequently than respondents who answered "Nearly all of the past 30 days."

PREVENTION: *During the past 30 days, how often have you seen or heard an advertisement, message, or product label about preventing harmful marijuana use or avoiding marijuana use? (Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing, and online or cell phone advertisements.)*

a. A few of the past 30 days
About half of the past 30 days
Nearly all of the past 30 days
I have not seen or heard marijuana prevention advertising or messaging in the past 30 days

Respondents frequently expressed uncertainty about what constituted an anti-marijuana message and whether they had seen one in the past 30 days, or, indeed, ever. Thus, while the question references the frequency of respondents' seeing or hearing anti-marijuana messages, question response was primarily conditioned by whether respondents could conceive of an existing anti-marijuana message at all. While in the ADVERTISING item, respondents' answers were also influenced by their access to and awareness of advertising, access and awareness only rarely emerged in evaluation of this item, because conceiving of a message was, in itself, a challenge.

Respondents appeared to grasp at potential messages they had seen, draw comparisons with other substances, and make specious estimates as to the frequency of their encounters; respondents' answers often lacked details of the specific advertisements that they were able to recall in the ADVERTISING item. For example, one respondent answered, "Nearly all of the past 30 days," but in probing, explained his answer as follows:

Interviewer: What have you seen here?

Respondent: I mean, everything is a drug, even if it's legal.

Interviewer: But have you seen ads warning people not to use marijuana?

Respondent: Well, I see that on packs of cigarettes.

Interviewer: Have you seen it for marijuana, though?

Respondent: Yes.

Interviewer: Where?

Respondent: I can't remember.

When respondents were able to identify anti-marijuana messages, they referenced public safety announcements (for example, "say no to drugs" commercials), political campaigns against marijuana legalization, anti-impaired driving billboards (for example, "Get your head out of a cloud"), and product safety labels or dispensary messaging (for example, "Start low, go slow" to manage dosage). However, the dominant understanding was no conception of what this might look like. As one respondent put it, "No, I never even heard a bad story about marijuana."

Respondents' understanding of the response options did not appear to meaningfully differ from the previous question, ADVERTISING, although interviewers did not probe on these separately. No respondents included CBD products in their conception of marijuana prevention advertising or messaging.

MJEFFECTS: *In the past 12 months, did you seek help for adverse or negative health effects caused by marijuana at any of these places? [Version 2: You can say yes or no to each one.] Select all that apply.*

a. Emergency department
b. Poison control center
c. Doctor or other health professional
d. Walk-in clinic
e. Telephone health service/helpline
f. Addiction support service
g. Other (please specify): _____
h. *Version 1:* I did not seek help for adverse or negative effects caused by marijuana

Respondents understood this question to refer to their use of health services to treat any potential health problems associated with their marijuana use. Most respondents did not report seeking help for negative health effects because they could not conceive of any negative health effects or because they did not use marijuana. As one put it, "I hear more negative effects related to alcohol but not marijuana in general, because rarely do you get upset when you smoke weed…I don't see people getting angry, getting hostile, belligerent. They mellow out."

Some respondents identified negative health effects, such as temporary anxiety or nausea, for which they nonetheless did not seek follow-on treatment. Other respondents reported on the experiences of people they knew or encountered, including one who said she knew "someone who got tachycardia and went into respiratory distress and had to go to the ER from too much marijuana."

Two respondents identified instances in which they sought out help for the negative health effects of marijuana use. One respondent explained that he had to go to the emergency department after ingesting too many edibles during the COVID-19 pandemic lockdowns; he "passed out and started convulsing." This respondent answered "I did not seek help for adverse or negative health effects caused by marijuana" because his experience was more than a year before the interview. Another respondent reported going to a dentist ("doctor or other health professional") because his "teeth were getting kind of brown because of marijuana," which he considered a negative health effect of marijuana smoking.

<u>Question administration</u>

Because no respondents indicated seeking help for adverse or negative health effects caused by marijuana use in the first half of the interviews, for the purposes of this study, the CCQDER team added a filter question prior to this question:

In the past 12 months, did you seek help for adverse or negative health effects caused by marijuana?

a. Yes
No (If no, skip to LEGALIZATION)

Most respondents answered "No" to the filter question or "I did not seek help for adverse or negative effects caused by marijuana" to the original question. Indeed, the addition of the filter question performed well because most respondents were unable to conceive of any negative health effects caused by marijuana. In this regard, the filter question reduced burden for respondents who had no need to hear the extensive list of health-related categories.

Version 1: ***LEGALIZATION_1:*** *[State name] legalized marijuana for [adult use/medical use] in [year]. Overall, how has [state name]'s legalization of [adult-use/medical-use] marijuana affected the quantity of marijuana you use, if at all?*

a. Legalization has not affected my use of marijuana
b. My marijuana use has increased
c. My marijuana use has decreased
d. My marijuana use has stayed about the same
e. I never or rarely use marijuana

Version 2: ***LEGALIZATION_2:*** *[State name] legalized marijuana for [adult use/medical use] in [year]. Overall, after [state name] legalized [adult-use/medical-use] marijuana, how has the quantity of marijuana you use changed, if at all?*

a. My marijuana use has increased
b. My marijuana use has decreased
c. My marijuana use has stayed about the same
d. I never or rarely use marijuana

Impact of version experiment

Version 1 (LEGALIZATION_1) of this item asks respondents to assess the impact of marijuana legalization in their state on the amount of marijuana they use. Version 2 (LEGALIZATION_2) of this item asks respondents to consider only the change in the amount they used since marijuana legalization in their state. Both items rely on providing accurate information to survey interviewers on the nature and timing of marijuana legalization at the state level, additions made to reduce respondent burden and focus respondent conceptions of legalization on a specific event. Respondents were randomly assigned to either version for the first 39 interviews. After the first 39 interviews, all eligible respondents received Version 1, as study analysts wanted to further explore the question that referenced causality. In this study, 20 respondents received the first version of the item, while 14 respondents received the second version of the item; respondents in states where only CBD product use was legal did not receive either version.

When answering either version of this question, respondents offered both causal and non-causal interpretations. That is, some respondents understood these items to ask how their use of marijuana changed, if at all, because of legalization in the named state, while other respondents understood these items to ask about the quantity they used without any causal relationship to marijuana legalization. The presence of both causal and non-causal interpretations among respondents who received either version of the question suggests that the experiment with question wording, which was intended to produce causal interpretations in Version 1 and non-causal interpretations in Version 2, was not successful. Potential reasons for this are outlined below. One overarching exception was the group of respondents who do not use marijuana, who answered based on their non-use and did not consider legalization.

Causal interpretations

Both respondents who received Version 1 and those who received Version 2 tended to understand the items as asking about the causal impact of legalization on their marijuana use, writ large. For example, one respondent to Version 2 pointed to factors associated with legalization as the reason for the increase in her use: her use has "definitely increased…because [of] accessibility. Just knowing these products are clean, they're actually getting lab results, they get tested." Another respondent to Version 1, who answered "Legalization has not affected my use," explained that "it didn't change anything for me. If anything, I probably smoke more, but it's not because it was legalized…I think my tolerance went up, and so I started smoking more." This respondent identified an increase in

her use, but because she did not causally relate it to legalization, she did not report it. Other respondents to both versions of the item pointed to different aspects of legalization, including ease of access, location of purchase (dispensary rather than dealer), and a sense of openness around use, that affected their use in ways other than quantity of consumption. One respondent who used marijuana infrequently for medical purposes – not "to get high" – said that her use has stayed about the same, but she now feels the "freedom to [use marijuana]."

Noncausal interpretations

Some respondents either did not take note of legalization or began using marijuana well after legalization. In both cases, because legalization was not relevant to them, respondents did not associate legalization with the amount of marijuana they used. One respondent to Version 1 initially answered, "I mainly started using it after it was legalized," which was not one of the response options. He went on to explain that he had "experienced [marijuana use] before, when I was 18," but stopped using marijuana for more than a decade. Later, well after his state legalized marijuana for adult use, he began using marijuana again. In the end, he chose "My marijuana use has increased" because, as he said, "technically it [has] increased," even though he did not see legalization as causing his increased use. This respondent's experience suggests that Version 1 may not perform well for respondents for whom the salient period of marijuana use occurs well after legalization took place or who turned 18 years old when marijuana was already legalized. These respondents may not be able to causally relate legalization to their use. Another respondent, who received Version 2, said that she "wasn't really paying attention to [legalization]" and answered "My marijuana use has decreased" because she recently quit using marijuana, not because she associated quitting with legalization.

Response options

Some respondents reported difficulty choosing between response options to Version 1. One respondent tried to choose between options a) "Legalization has not affected my use of marijuana" and d) "My marijuana use has stayed about the same." She decided on "Legalization has not affected my use of marijuana" but felt that the question was a "trick question" because these options were "basically saying the same thing in two different ways." The presentation of both options led the respondent to parse the potential differences between them, especially the phrase "about the same" in option d), but the respondent found doing so difficult and burdensome. Similarly, one respondent who did not use marijuana answered "I never or rarely use marijuana" but immediately followed up her answer with "It really hasn't affected me. No." To this respondent, the most relevant answer was "I never or rarely use marijuana," but both answers aligned with her experience.

COMPOSITION: *When you use CBD or marijuana products, which of the following best describes the product you use most often? Your best guess is fine.*

a. High THC, Low CBD
b. High THC, High CBD
c. Low THC, Low CBD
d. Low THC, High CBD
e. Other
f. Not sure
g. I rarely or never use marijuana or CBD products

Respondents generally understood this question to ask about the chemical composition of marijuana or CBD products they use. Most respondents who used marijuana or CBD products provided an answer to this question that identified the chemical composition of a product. To do so, respondents either used the product label, which identified the percentage of the product made up of THC or CBD, the quantity of THC or CBD in the product, or the ratio of THC to CBD in the product, or respondents relied on latent understandings of THC as the chemical that "gets you high."

Understandings of product composition

Respondents who used product labels to inform their response explained that this was a key difference "between street dealer and dispensary – they have their product marked. They have the name; they have the THC amount. All that's included in the label." These respondents asked dispensary employees for advice, conducted searches online for the composition of their preferred cannabis strains, or recalled advertising about THC and CBD levels. Some respondents read or recalled their product labels to the interviewers:

> *One of my favorite gummies, it's right on the label. This is 100 milligrams of THC and 100 milligrams of CBD.*
>
> *The last gummy I had was 1:1. 10 milligrams THC and 10 milligrams CBD. So, I think to the average person that's high.*
>
> *It just says CBD on it, but I believe it is low THC…It just says CBD in big, huge letters.*

Importantly, not all respondents who used product labels as the basis for their answer were able to provide a response about chemical composition. Some respondents selected "Not sure" or "Other" because they knew the label had information on the amount, but they were uncertain of the precise composition. Others focused on the THC amount but were not sure about the amount or proportion of CBD. As one respondent, who answered "Other," put it, "It's labeled how much, and there might have been CBD in there. I just didn't pay attention to it…I'm interested in the THC level." Responses like these illustrate the need for categories like e) and f), since respondents may genuinely not know the answer or feel comfortable guessing.

Some respondents relied on latent understandings of chemical effects instead of product labels. These respondents knew that "the higher the THC, the higher it gets you" and that "THC is responsible for what makes us feel high." Respondents also guessed that the type of marijuana they purchase at dispensaries would generally be high in THC. One respondent, who answered "High THC, Low CBD," said, "I just feel because flower, usually when you get it at a dispensary, is mostly high THC, low CBD…I usually get flower which gets you high, with higher THC." Conversely, some respondents who used marijuana for medical purposes answered "Low THC, High CBD" because they understood CBD to be the component that most assisted medically. Respondents who used only CBD products either relied on the product label or their understanding of the product as clearly CBD-dominant, because it did not get them "high."

Respondents who assumed their product had no CBD sometimes found this question challenging to answer, as no response option precisely aligned with their product use. For example, one respondent initially said that she doesn't "have any products that have THC and CBD," but thought about it again and decided that "CBD is in regular THC." She chose "High THC, Low CBD."

<u>Choosing the "product you use most often"</u>

Most respondents did not seem to have difficulty picking the product on which they based their response. For example, one respondent used a "live resin concentrate" high in THC, and another explained that he mostly uses "the flower, like the actual buds." However, a few respondents took time to decide which product they used most, particularly when the composition of those products differed. A respondent who used both a "high CBD and low THC…gummy edible" and "high THC flower" asked the interviewer, "I have to choose one?" He settled on "High THC, Low CBD." Another respondent answered "Not sure" because the distinction between THC and CBD was not how she understood her product – rather, she said, "I'm like, indicas and sativas" – and because she varies the THC content of what she takes based on her schedule, taking a lower THC product when she has to go to work.

A few respondents reported using CBD on more days than they used marijuana but nonetheless answered based on their marijuana use. One of these respondents explained that "I smoke more than I take CBD," even though he reported using CBD gummies 12 and marijuana 10 out of the past 30 days. Another reported using CBD incense and lotion every day out of the past 30 days and marijuana only 10 days, "on the weekends and occasionally during the week." These respondents, both of whom answered "High THC, Low CBD," may have based their answer on

high-THC marijuana because the psychoactive effects of THC were more salient than the ambient, non-psychoactive effects of CBD products, particularly CBD incense.

This question may be vulnerable to order effects that prime respondents to answer based on either CBD products or marijuana depending on where it is placed. Two respondents who received the question immediately after questions about CBD product use initially answered based on their limited CBD product use. One respondent said "Low THC, High CBD" because he "used some salve for joint pain and that kind of thing…I don't buy it in perpetuity. It's just like, I have it for a while until I use it up, and then it may be months before I do it again." This respondent had used marijuana all of the past 30 days, although his use pattern was similar to that of CBD in that "when I get it, I have it. Then, when it goes away, I may get it, I may not." Another respondent shook his head and said "Don't use. I don't use CBD products. My wife tried some a couple years ago, and I'm just not, I'm just not interested." After the interviewer repeated the question twice, the respondent said, "Okay, so I guess – man, I don't know how to tell how high the THC content is. I'm hoping it's a high content!" Both respondents appeared to be primarily thinking about CBD products because of the recent questions on CBD product use.

Appendix 2: Sample Recruitment

1. For the purposes of study sample recruitment, CCQDER Operations Team researchers recruited people based on their cannabis product use and experience. Recruitment began the week of April 1, 2024. The CCQDER Operations Team made particular use of Reddit's active and diverse state-based cannabis user forums to recruit participants for interviews. Additionally, the team advertised on the Craigslist classified advertisements website in various cities nationwide and CCQDER's respondent database to solicit additional study participants. CCQDER researchers sought respondents from the categories listed below based on CCQDER's prior evaluation of these items, which prioritized users of cannabis products and recruited users of these products in various geographic locations that differed in their approach to cannabis legalization.

- **Non-users:** Respondents who had never used either CBD or marijuana products, including psychoactive hemp-derived products like delta-8 THC.
- **Former users:** Respondents who used CBD or marijuana products outside of the 12 months before screening into the study.
- **Infrequent users:** Respondents who used CBD or marijuana products within the 12 months, but not within 30 days, of screening into the study.
- **Non-medical marijuana users:** Respondents who used marijuana products, but not CBD products, within 30 days of screening into the study and who did not report using marijuana for medical purposes.
- **Medical marijuana users:** Respondents who reported using marijuana for medical purposes within 30 days of screening into the study and who did not use CBD products.
- **Delta-8 THC users:** Respondents who reported using delta-8 THC for any purpose within 30 days of screening into the study and who did not use CBD products.
- **CBD-only users:** Respondents who reported using CBD products within 30 days of screening into the study and who did not use marijuana products, including psychoactive hemp-derived products like delta-8 THC.
- **Multi-product users:** Respondents who reported using both CBD and marijuana products within 30 days of screening into the study.

2. The previous round of evaluation did not include "non-users," "former users," or "infrequent users" (1). The telephone-based screener questions used to construct these categories are included below as Table 2.

Table 2: Telephone-Based Screener Questions on Cannabis Use and Experiences

3. Screener Question	4. Response Options
5. Have you ever used any cannabis product such as marijuana, hemp, Delta-8, or CBD?	6. Yes 7. No [If no, **non-user**, go to demographic questions]
8. Have you used any of those cannabis products in the last 12 months?	9. Yes 10. No [If no, **former user**, go to demographic questions]
11. Which of the following products have you used? You can tell me all that apply.	12. Marijuana, pot, or weed 13. Other psychoactive products, like delta-8 14. Hemp or CBD products
15. Have you used any of those cannabis products in the last 30 days?	16. Yes 17. No [If no, **infrequent user**]
18. What do you use cannabis for? You can tell me any that apply.	19. Recreational use 20. Medical use

21. SOURCE: National Center for Health Statistics, Collaborating Center for Questionnaire Design and Evaluation Research, 2024.

22. In addition, CCQDER staff used publicly-available resources to categorize respondent legal jurisdictions for analytic purposes in this study. The categories used reflect the legal status of cannabis products during interviewing (April through August 2024) and are as follows:

23. **Adult-use:** These jurisdictions have legalized retail sales of adult nonmedical cannabis.
24. **Medical-only use:** These jurisdictions have legalized medical cannabis on a broad basis but have continued to penalize adult nonmedical cannabis use.
25. **CBD-only:** These jurisdictions have only legalized CBD or low-THC products or have accepted the provisions of the Agricultural Improvement Act of 2018, commonly known as the "2018 Farm Bill," which removed CBD derived from hemp from the schedule of drugs under the Controlled Substances Act and placed it under the regulatory jurisdiction of the Department of Agriculture.

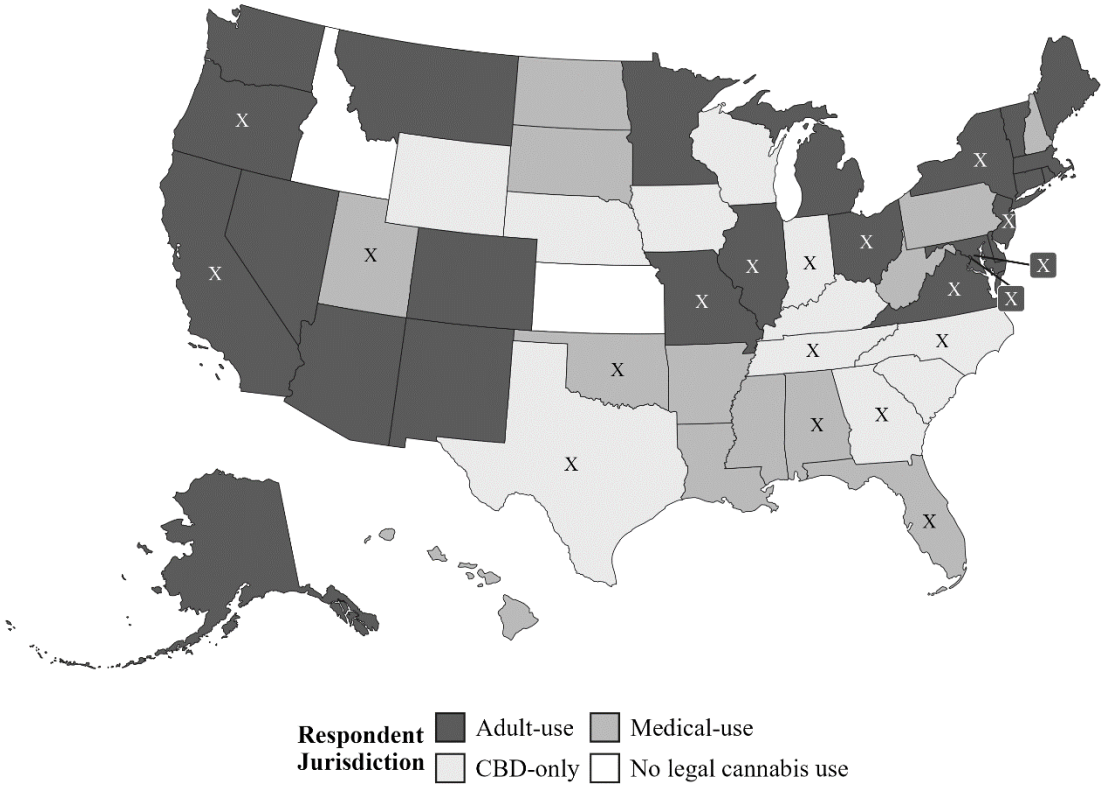
At the time of sample recruitment, Idaho and Kansas had not yet allowed for purchase of CBD products that contained even trace amounts of THC and otherwise fully criminalize marijuana use and possession. CCQDER excluded participants from these states from this study. A full list of jurisdictions and their associated categories is included in Table 3. Respondent jurisdictions are mapped in Figure 1.

Table 3: Jurisdictions by Status of Legal Cannabis Use

26. Category	*27. Jurisdiction*		
28. Adult-use	29. Alaska	38. Arizona	46. California
	30. Colorado	39. Connecticut	47. District of Columbia
	31. Delaware	40. Illinois	48. Maine
	32. Maryland	41. Massachusetts	49. Michigan
	33. Minnesota	42. Missouri	50. Montana
	34. New Jersey	43. New Mexico	51. New York
	35. Nevada	44. Ohio	52. Oregon
	36. Rhode Island	45. Vermont	53. Virginia
	37. Washington		54.
55. Medical-only use	56. Alabama	61. Arkansas	65. Florida
	57. Hawai'i	62. Louisiana	66. Mississippi
	58. New Hampshire	63. North Dakota	67. Oklahoma
	59. Pennsylvania	64. South Dakota	68. Utah
	60. West Virginia		
69. CBD-only	70. Georgia	74. Indiana	78. Iowa
	71. Kentucky	75. Nebraska	79. North Carolina
	72. South Carolina	76. Tennessee	80. Texas
	73. Wisconsin	77. Wyoming	81.

82. NOTE: This study included respondents from jurisdictions in bold.
83. SOURCE: Independent analysis, National Center for Health Statistics, Collaborating Center for Questionnaire Design and Evaluation Research, 2024.

Figure 1: Map of Study Sample by Legal Jurisdiction



NOTE: Respondents in this study were recruited from states marked with an "X" on the map.

Appendix 3: Current Study Questionnaires

Version 1

CBD. The next question asks about CBD products, that is, cannabis products that are not intended to get you "high." These products are generally derived from hemp. Do not count cannabis products that are intended to get you "high" when answering this question.

During the past 30 days, on how many days did you use CBD products? [0-30 days] **[If 0 days, then skip to Question 4]**

For the rest of the survey, we will refer to these types of cannabis products as "CBD products."

CBDUSE. When you used a CBD product during the past 30 days, how did you use it? (Check all that apply) Did you:

a. Apply it to the skin (for example, in a lotion, gel, oil, balm, or bath salt)
b. Smoke it (for example, in a joint, blunt, or cigar)
c. Eat it or drink it, including drops, sprays, or tinctures (for example, in edibles like brownies or gummies or in capsules, or in tea, cola, or alcohol)
d. Vaporize it (for example, in an e-cigarette-like vaporizer or another vaporizing device)
e. Dab it (for example, using a dabbing rig, knife, or dab pen)
f. Use it some other way

CBDBUY. In the past 30 days, how did you get the CBD products you use? Do you: (Check all that apply)

a. buy it from a medical or retail dispensary
b. buy it from a smoke shop, grocery store, gas station, mall, or other convenience store
c. buy it from a friend or acquaintance
d. get it for free or share someone else's
e. grow it yourself at home or have someone grow it for you
f. have it delivered to you (from the internet, mail order, or delivery service)
g. get it from somewhere else
h. I did not obtain CBD products from any source in the past 30 days.

MARIJUANA. The next set of questions ask about marijuana, that is, the kind of cannabis that is intended to get you "high," including products like delta-8 THC. During the past 30 days, on how many days did you use marijuana?

_____[0-30 days] **[If 0 days, then skip to Question 9]**

For the rest of the survey, we will refer to these types of cannabis products as "marijuana."

MJBUY. In the past 30 days, how did you get the marijuana you use? Did you: (Check all that apply)

a. buy it from a medical or retail dispensary
b. buy it from a grocery store, gas station, mall, or other convenience store
c. buy it from a dealer (in person) or friend
d. get it for free or share someone else's
e. grow it yourself at home or have someone grow it for you
f. have it delivered to you (from the internet, mail order, or delivery service)
g. get it from somewhere else
h. I did not obtain marijuana from any source in the past 30 days.

COUSE. When you used marijuana in the past 30 days, did you use any of the following substances at the same time or within a few hours? (Select all that apply)

a. A tobacco or nicotine product like a cigarette, cigar, blunt, or vape
b. Alcohol

c. Prescription medications, including opioids taken as directed by your doctor
d. Prescription opioids not prescribed to you or not used as directed by your doctor
e. Psychedelics, such as LSD, acid, or mushrooms
f. Other drugs, including heroin or illicit fentanyl
g. I did not use marijuana with other substances

REPLACE. When you used marijuana in the past 30 days, did you try to replace your use of any of the following substances? Please include only substances that you began replacing within the past 30 days. (Select all that apply)

a. A tobacco or nicotine product like a cigarette, cigar, blunt, or vape
b. Alcohol
c. Prescription medications, including opioids taken as directed by your doctor
d. Prescription opioids not prescribed to you or not used as directed by your doctor
e. Psychedelics, such as LSD, acid, or mushrooms
f. Other drugs, including heroin or illicit fentanyl
g. I did not replace my use of other substances with marijuana

DRIVING. During the past 30 days, have you driven a vehicle while high from marijuana use?

a. Yes
b. No

HPASK. In the past 12 months, has a health professional, such as a doctor, nurse, or mental health professional, asked you about your marijuana use? Do not include office intake forms completed prior to an appointment.

a. Yes
b. No
c. I haven't seen a health professional in the past 12 months

HPADVICE. In the past 12 months, has a health professional, such as a doctor, nurse, or therapist, done any of the following? Select all that apply.

a. Told you to cut back on or not use marijuana
b. Recommended medical marijuana or encouraged you to seek out marijuana for treatment purposes
c. Told you to change the way you use marijuana, for example, from smoking to edibles
d. Given you other advice about use of marijuana
e. They did not provide any advice about marijuana use
f. I have not seen a health professional in the past 12 months

CUTDOWN. During the past 12 months, were you able to cut down on or stop using marijuana every time you wanted to or tried to?

a. Yes
b. No
c. I did not want or try to cut down on or stop using marijuana
d. I rarely or never use marijuana

MJLIVESWITH. Does anyone who currently lives with you use marijuana?

a. Yes
b. No
c. Don't know

ADVERTISING. For the next two questions, please only consider marijuana, that is, the kind of cannabis that is intended to get you "high," including products like delta-8 THC. Do not include CBD products.

During the past 30 days, how often have you seen or heard an advertisement for marijuana products or stores or seen a marijuana storefront? (Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing like sign spinners or sandwich boards, online or cell phone advertisements, and dispensary newsletters or rewards programs.)

a. A few of the past 30 days
b. About half of the past 30 days
c. Nearly all of the past 30 days
d. I have not seen or heard marijuana product advertising in the past 30 days

PREVENTION. During the past 30 days, how often have you seen or heard an advertisement, message, or product label about preventing harmful marijuana use or avoiding marijuana use? (Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing, and online or cell phone advertisements.)

a. A few of the past 30 days
b. About half of the past 30 days
c. Nearly all of the past 30 days
d. I have not seen or heard marijuana prevention advertising or messaging in the past 30 days

MJEFFECTS. In the past 12 months, did you seek help for adverse or negative health effects caused by marijuana at any of these places? Select all that apply.

a. Emergency department
b. Poison control center
c. Doctor or other health professional
d. Walk-in clinic
e. Telephone health service/helpline
f. Addiction support service
g. Other (please specify): _____
h. I did not seek help for adverse or negative effects caused by marijuana.

[Note: Do not ask Question 16 if marijuana is not legal in the respondent's state. Randomly assign eligible respondents to Version 1 or Version 2.]

Version 1: LEGALIZATION_1. [State name] legalized marijuana [for adult use/medical use] in [year]. Overall, how has [state name]'s legalization of [adult-use/medical-use] marijuana affected the quantity of marijuana you use, if at all?

a. Legalization has not affected my use of marijuana
b. My marijuana use has increased
c. My marijuana use has decreased
d. My marijuana use has stayed about the same
e. I never or rarely use marijuana

Version 2: LEGALIZATION_2. [State name] legalized marijuana [for adult use/medical use] in [year]. Overall, after [state name] legalized [adult-use/medical-use] marijuana, how has the quantity of marijuana you use changed, if at all?

a. My marijuana use has increased
b. My marijuana use has decreased
c. My marijuana use has stayed about the same
d. I never or rarely use marijuana

COMPOSITION. When you use CBD or marijuana products, which of the following best describes the product you use most often? Your best guess is fine.

a. High THC, Low CBD
b. High THC, High CBD
c. Low THC, Low CBD
d. Low THC, High CBD
e. Other
f. Not sure
g. I rarely or never use marijuana or CBD products

Version 2

MARIJUANA. The next set of questions ask about marijuana, that is, the kind of cannabis that is intended to get you "high," including products like delta-8 THC. During the past 30 days, on how many days did you use marijuana?

_____[0-30 days] **[If 0 days, then skip to Question 9]**

For the rest of the survey, we will refer to these types of cannabis products as "marijuana."

MJBUY. In the past 30 days, how did you get the marijuana you use? **You can say yes or no to each one.** Did you: (Select all that apply)

a. buy it from a medical or retail dispensary
b. buy it from a grocery store, gas station, mall, or other convenience store
c. buy it from a dealer (in person) or friend
d. get it for free or share someone else's
e. grow it yourself at home or have someone grow it for you
f. have it delivered to you (from the internet, mail order, or delivery service)
g. get it from somewhere else
h. I did not obtain marijuana from any source in the past 30 days.

COUSE. When you used marijuana in the past 30 days, did you use any of the following substances at the same time or within a few hours? **You can say yes or no to each one.** (Select all that apply)

a. A tobacco or nicotine product like a cigarette, cigar, blunt, or vape
b. Alcohol
c. Prescription medications, including opioids taken as directed by your doctor
d. Prescription opioids not prescribed to you or not used as directed by your doctor
e. Psychedelics, such as LSD, acid, or mushrooms
f. Other drugs, including heroin or illicit fentanyl
g. I did not use marijuana with other substances

REPLACE. When you used marijuana in the past 30 days, did you try to replace your use of any of the following substances? Please include only substances that you began replacing within the past 30 days. **You can say yes or no to each one.** (Select all that apply)

a. A tobacco or nicotine product like a cigarette, cigar, blunt, or vape
b. Alcohol
c. Prescription medications, including opioids taken as directed by your doctor
d. Prescription opioids not prescribed to you or not used as directed by your doctor
e. Psychedelics, such as LSD, acid, or mushrooms
f. Other drugs, including heroin or illicit fentanyl
g. I did not replace my use of other substances with marijuana

DRIVING. During the past 30 days, have you driven a vehicle while high from marijuana use?

a. Yes
b. No

HPASK. In the past 12 months, has a health professional, such as a doctor, nurse, or mental health professional, asked you about your marijuana use? Do not include office intake forms completed prior to an appointment.

a. Yes
b. No
c. I haven't seen a health professional in the past 12 months

HPADVICE. In the past 12 months, has a health professional, such as a doctor, nurse, or therapist, done any of the following? **You can say yes or no to each one.** Select all that apply.

a. Told you to cut back on or not use marijuana

b. Recommended medical marijuana or encouraged you to seek out marijuana for treatment purposes
c. Told you to change the way you use marijuana, for example, from smoking to edibles
d. Given you other advice about use of marijuana
e. They did not provide any advice about marijuana use
f. I have not seen a health professional in the past 12 months

CUTDOWN. During the past 12 months, were you able to cut down on or stop using marijuana every time you wanted to or tried to?

a. Yes
b. No
c. I did not want or try to cut down on or stop using marijuana
d. I rarely or never use marijuana

MJLIVESWITH. Does anyone who currently lives with you use marijuana?

a. Yes
b. No
c. Don't know

ADVERTISING. For the next two questions, please only consider marijuana, that is, the kind of cannabis that is intended to get you "high," including products like delta-8 THC. Do not include CBD products.

During the past 30 days, how often have you seen or heard an advertisement for marijuana products or stores or seen a marijuana storefront? (Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing like sign spinners or sandwich boards, online or cell phone advertisements, and dispensary newsletters or rewards programs.)

a. A few of the past 30 days
b. About half of the past 30 days
c. Nearly all of the past 30 days
d. I have not seen or heard marijuana product advertising in the past 30 days

PREVENTION. During the past 30 days, how often have you seen or heard an advertisement, message, or product label about preventing harmful marijuana use or avoiding marijuana use? (Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing, and online or cell phone advertisements.)

a. A few of the past 30 days
b. About half of the past 30 days
c. Nearly all of the past 30 days
d. I have not seen or heard marijuana prevention advertising or messaging in the past 30 days

MJEFFECTS_FILTER. In the past 12 months, did you seek help for adverse or negative health effects caused by marijuana?

a. Yes
b. No (if No, skip to Q14)

MJEFFECTS. In the past 12 months, did you seek help for adverse or negative health effects caused by marijuana at any of these places? **You can say yes or no to each one.** Select all that apply.

a. Emergency department
b. Poison control center
c. Doctor or other health professional
d. Walk-in clinic
e. Telephone health service/helpline
f. Addiction support service
g. Other (please specify): _____
h. I did not seek help for adverse or negative effects caused by marijuana.

[Note: Do not ask Question 14 if marijuana is not legal in the respondent's state. Randomly assign eligible respondents to Version 1 or Version 2.]

Version 1: LEGALIZATION_1. [State name] legalized marijuana [for adult use/medical use] in [year]. Overall, how has [state name]'s legalization of [adult-use/medical-use] marijuana affected the quantity of marijuana you use, if at all?

a. Legalization has not affected my use of marijuana
b. My marijuana use has increased
c. My marijuana use has decreased
d. My marijuana use has stayed about the same
e. I never or rarely use marijuana

Version 2: LEGALIZATION_2. [State name] legalized marijuana [for adult use/medical use] in [year]. Overall, after [state name] legalized [adult-use/medical-use] marijuana, how has the quantity of marijuana you use changed, if at all?

a. My marijuana use has increased
b. My marijuana use has decreased
c. My marijuana use has stayed about the same
d. I never or rarely use marijuana

CBD. The next question asks about CBD products, that is, cannabis products that are not intended to get you "high." These products are generally derived from hemp. Do not count cannabis products that are intended to get you "high" when answering this question.

During the past 30 days, on how many days did you use CBD products?

_____[0-30 days] **[If 0 days, then skip to Question 18]**

For the rest of the survey, we will refer to these types of cannabis products as "CBD products."

CBDUSE. When you used a CBD product during the past 30 days, how did you use it? **You can say yes or no to each one.** (Check all that apply) Did you:

a. Apply it to the skin (for example, in a lotion, gel, oil, balm, or bath salt)
b. Smoke it (for example, in a joint, blunt, or cigar)
c. Eat it or drink it, including drops, sprays, or tinctures (for example, in edibles like brownies or gummies or in capsules, or in tea, cola, or alcohol)
d. Vaporize it (for example, in an e-cigarette-like vaporizer or another vaporizing device)
e. Dab it (for example, using a dabbing rig, knife, or dab pen)
f. Use it some other way

CBDBUY. In the past 30 days, how did you get the CBD products you use? **You can say yes or no to each one.** Do you: (Check all that apply)

a. buy it from a medical or retail dispensary
b. buy it from a smoke shop, grocery store, gas station, mall, or other convenience store
c. buy it from a friend or acquaintance
d. get it for free or share someone else's
e. grow it yourself at home or have someone grow it for you
f. have it delivered to you (from the internet, mail order, or delivery service)
g. get it from somewhere else
h. I did not obtain CBD products from any source in the past 30 days.

COMPOSITION. When you use CBD or marijuana products, which of the following best describes the product you use most often? Your best guess is fine.

a. High THC, Low CBD

b. High THC, High CBD
c. Low THC, Low CBD
d. Low THC, High CBD
e. Other
f. Not sure
g. I rarely or never use marijuana or CBD products

Appendix 4: Previous Study Questionnaire

Interviewers should read the questions as written aloud to the respondent and read aloud all response options, with the exception of items in red, open-ended responses, or response options limited to Yes/No. The instrument may be probed concurrently or retrospectively depending on your preference; please document your choice in the notes.

The next question asks about use of hemp or CBD-only products. Hemp and CBD-only products are typically found in stores such as grocery stores, gas stations, smoke shops, and malls. Do not count marijuana products when answering this question.

During the past 30 days, on how many days did you use hemp or CBD-only products?

[# 0-30]

[Ask if response to #1 is 1 - 30 days, otherwise skip to Q#4]

When you used a hemp or CBD-only product during the past 30 days, how did you use it? (check all that apply) Only read parentheticals in red if asked for clarification.

Did you:
a. Apply it to the skin (for example, in a lotion, gel, oil, balm)
b. Smoke it (for example, in a joint, blunt, or cigar)
c. Eat it (for example, in brownies, cakes, cookies, or candies)
d. Drink it (for example, in tea, cola, alcohol, or tinctures)
e. Vaporize it (for example, in an e-cigarette-like vaporizer or another vaporizing device)
f. Dab it (for example, using a dabbing rig, knife, or dab pen)
g. Use it some other way

How do you usually get the hemp or CBD-only products you use? Do you:
a. Buy it from a retail store
Buy it from a medical dispensary
Buy it from a grocery store, gas station, mall, or other convenience store
Buy it from a dealer or friend
Get it for free or share someone else's
Grow it yourself at home or have someone grow it for you
Get it from somewhere else

Version 1 (assigned randomly): The next set of questions ask about marijuana use. During the past 30 days, on how many days did you use marijuana?

[# 0-30]

Version 2 (assigned randomly): The next set of questions ask about marijuana use. Marijuana is also called pot, weed, or cannabis. Do not count hemp or CBD-only products when answering this question. During the past 30 days, on how many days did you use marijuana?

[# 0-30]

[Ask if response to #4 is 1 - 30 days, otherwise skip to Q#8]

When you used marijuana during the past 30 days, did you use any other substances at the same time or within a few hours? (Select all that apply)
a. A tobacco or nicotine product like a cigarette, cigar, blunt, or e-cigarette
b. Alcohol
c. Cocaine

d. Heroin or illicit fentanyl
e. Methamphetamine
f. Prescription opioids either not prescribed to you or used in a way that was not directed by your doctor.
g. Other drugs
h. I did not use marijuana with other substances

[Ask if response to #4 is 1 - 30 days, otherwise skip to Q#8]

When you used marijuana during the past 30 days, did you use it to try to replace your use of any of the following substances? (Select all that apply)

a. A tobacco or nicotine product like a cigarette, cigar, blunt, or e-cigarette.
b. Alcohol
c. Cocaine
d. Heroin or illicit fentanyl
e. Methamphetamine
f. Prescription opioids either not prescribed to you or used in a way that was not directed by your doctor.
g. Other drugs
h. I did not replace my use of other substances with marijuana

[Ask if response to #4 is 1 - 30 days, otherwise skip to Q#8]

During the past 30 days, have you driven a vehicle while still affected by marijuana use?

a. Yes
No

In the past 12 months, has a health professional asked you about your marijuana use?

a. Yes
No
I haven't seen a health professional in the past 12 months

In the past 12 months, has a health professional advised you to:

a. Cut back on or stop using marijuana
b. Start or continue using marijuana medically
c. They did not provide any advice about marijuana use.
d. I have not seen a health professional in the past 12 months.

During the past 12 months, did you want to cut down or stop using marijuana?

a. Yes
b. No

During the past 12 months, were you able to cut down or stop using marijuana every time you wanted to or tried to?

a. Yes
b. No

Does anyone who lives with you use marijuana?

a. Yes
b. No
c. Don't know
d. Refused

During the past 30 days, how often have you seen or heard an advertisement for marijuana products or stores? Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing like sign spinners or sandwich boards, and online or cell phone advertisements.

a. A few times in the past 30 days
b. Several of the past 30 days

c. Nearly all of the past 30 days
d. I have not seen or heard marijuana product advertising in the past 30 days

During the past 30 days, how often have you seen or heard an advertisement or message about preventing harmful marijuana use or avoiding marijuana use? (Include TV, radio, signs and billboards, newspapers and magazines, pamphlets or flyers, streetside marketing, and online or cell phone advertisements.)
a. A few times in the past 30 days
b. Several of the past 30 days
c. Nearly all of the past 30 days
d. I have not seen or heard marijuana prevention advertising or messaging in the past 30 days

How has your marijuana use changed during the COVID-19 pandemic? Has it:
a. Increased
b. Decreased
c. Stayed about the same
d. I never or rarely use marijuana

Overall, how has your marijuana use changed since marijuana was legalized in your state?
a. It has increased
b. It has decreased
c. It has stayed about the same
d. I never or rarely use marijuana
e. Marijuana is not legal for use in my state

[Skip if response to #15 is d. and if response to #4 is 0 days.]
How do you usually get the marijuana you use? Do you:
a. buy it from a retail marijuana store
b. buy it from a medical dispensary
c. buy it from a grocery store, gas station, mall, or other convenience store
d. buy it from a dealer or friend
e. get it for free or share someone else's
f. grow it yourself at home or have someone grow it for you
g. get it from somewhere else

Version 1: When you use marijuana or cannabis, are you usually using a CBD product?
a. Yes
b. No
c. Don't know

Version 2: When you use marijuana or cannabis, which of the following best describes the product you use most often?
a. High THC, Low CBD
b. High THC, High CBD
c. Low THC, Low CBD
d. Low THC, High CBD
e. Other
f. Not sure

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