Refining the Marijuana Purchase Task: Using Qualitative Methods to Inform Measure Development

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Abstract

Behavioral economic demand for cannabis (i.e., relative reinforcing value) can be measured via marijuana purchase tasks (MPTs). However, commodity ambiguities pose challenges and design concerns exist regarding current MPTs. The aim of this two-phase study was to modify and improve a MPT using qualitative methods. Phase I: Focus groups were conducted with regular (i.e., average use once/week) cannabis users (n = 31; 6-7 per group; mean (SD) age = 26 (7); 28% female). Focus groups followed a semi-structured agenda, and executive summaries were made concerning key MPT themes. Feedback was used to refine the MPT. Phase II: Cognitive interviews using the refined MPT were conducted with regular cannabis users (n = 20; mean (SD) age = 28 (8); 50% female). Phase I: Focus group analyses highlighted four critical areas for MPT improvement: 1) unit of purchase, 2) cannabis quality, 3) time duration specified for use episode, and 4) price. Participants suggested using grams as the unit of purchase, tailoring cannabis quality to the individual, and clarifying intended episode length. Phase II: Cognitive interviewing indicated additional areas for task refinement, resulting in a second iteration of the MPT based on the two phases. Qualitative research in both phases suggested a number of substantive modifications to the MPT format. MPT modifications are expected to improve comprehension,

ecological validity, and general construct validity. Findings highlight the importance of careful instructional set development for drug purchase tasks for heterogeneous products that do not have standard units of consumption.

Introduction

Perceived drug reinforcing value, or drug demand, is a key feature within a behavioral economic approach to the conceptualization of addiction (Bickel, Johnson, Koffarnus, MacKillop, & Murphy, 2014; MacKillop, 2016). Demand for a given substance can be measured by examining performance on a hypothetical drug purchase task (Jacobs & Bickel, 1999; Murphy & MacKillop, 2006) wherein quantitative relationships between drug consumption and drug cost are discerned (Hursh, Galuska, Winger, & Woods, 2005; Plebani et al., 2012). In these tasks, participants report how much of a substance they would purchase to consume at increasing price levels. Five indices of substance demand can be obtained via analysis of purchase task responses, including intensity (i.e., amount of drug consumed at zero or very low cost), O_{max} (i.e., total peak expenditure), P_{max} (i.e., price at maximum expenditure), breakpoint (i.e., cost at which consumption is suppressed to zero), and elasticity (i.e., rate at which consumption decreases as price increases). Moreover, indices of drug demand have consistently been related to frequency of use, cue-induced and self-reported craving, related problems, and cannabis dependence (Aston, Metrik, & MacKillop, 2015; Collins, Vincent, Yu, Liu, & Epstein, 2014; Metrik et al., 2016), alcohol (Amlung & MacKillop, 2014; Amlung, McCarty, Morris, Tsai, & McCarthy, 2015; MacKillop & Murphy, 2007; Murphy & MacKillop, 2006), and tobacco (Acker & MacKillop, 2013; Chase, Mackillop, & Hogarth, 2013; MacKillop et al., 2012, 2008; Murphy, MacKillop, Tidey, Brazil, & Colby, 2011), albeit with considerable heterogeneity in the relationships observed across studies.

Choosing an optimal substance unit of purchase is an integral part of purchase task design. Historically, measurement of alcohol and cigarettes has been expressed in standardized units of purchase (i.e., standard drink, tobacco cigarette). However, there are substantial differences that must be taken into account in the quantification of cannabis units. Assessment of demand for cannabis is arguably more complex than measurement of the relative value of other drugs due to the absence of established standards in cannabis use measurement (Cuttler & Spradlin, 2017). In addition, its often illicit status, unpredictable availability, and often unregulated sale further obscure and confound accurate measurement of relative value. Currently validated marijuana purchase tasks have queried cannabis users about hypothetical purchase behavior using both price per "joint" (i.e., marijuana cigarette) (Collins et al., 2014; Yu, Liu, Collins, Vincent, & Epstein, 2014) and price per "hit" (i.e., inhalation) (Aston, Metrik, Amlung, Kahler, & MacKillop, 2016; Aston et al., 2015; Metrik et al., 2016), and while there are benefits to each, both previously published MPTs have

limitations. For example, it can be difficult to quantify and characterize cannabis use behavior due to variation in use patterns (Mariani, Brooks, Haney, & Levin, 2011). There are significant individual differences in administration mode (Aston et al., 2015; Cooper & Haney, 2009), suggesting variability in the amount consumed per episode (Metrik et al., 2012). Individuals report utilizing several modes of cannabis administration including joints, pipes, bongs, one-hitters, blunts, spliffs, dab-rigs, vaporizers, and consumption of cannabis in edible form (Baggio et al., 2014; Lee, Crosier, Borodovsky, Sargent, & Budney, 2016; Loflin & Earleywine, 2014; B. L. Miller, Stogner, & Miller, 2016). Furthermore, legalization of cannabis for recreational use impacts the way in which cannabis is administered (Borodovsky, Crosier, Lee, Sargent, & Budney, 2016). Further complicating accurate assessment, the majority of cannabis users report frequently using with others. Sharing cannabis with other users can complicate the ability to accurately self-report use level and frequency, highlighting the importance of quantifying the smallest measurable unit of use and cost.

The first published study using a purchase task to assess demand for cannabis designated joints as the unit of purchase, and while all participants were trained to accurately conceptualize joint size, only 4% of the sample reported using joints as their usual administration mode (Collins et al., 2014). Similarly, in a sample in which the MPT has been previously validated (Aston et al., 2015), the majority of participants listed pipes as their typical mode of administration. The task assessed how many cannabis hits one would smoke at escalating prices, specifying that there were 10 hits of cannabis in a joint (limiting responses to 99 hits). Selection of hits as the unit of purchase on this MPT was intended to increase resolution by using a smaller unit of analysis. Participants were informed that the cannabis available for purchase was of average quality. In contrast, the task employed by Collins and colleagues specified that the hypothetical cannabis available for purchase was high-grade. Importantly, demand for cannabis is influenced by specification of quality (Vincent et al., 2017), thus designation of cannabis as average or high-grade may have differentially impacted demand. The time period specified in the instructions from Aston et al. (2015) was "amount smoked in a typical day," however, this timeframe may have been too broad, leading to extreme values for purchase at zero cost. Similarly, Collins and colleagues restricted the task timeframe to four hours, similar to what has traditionally been used in alcohol purchase tasks. However, while four hours may be appropriate for an alcohol consumption episode, it is unclear whether this timeframe is characteristic of a cannabis use episode. Taken together, these initial studies highlight the large degree of variability in cannabis use practices and emphasize the importance of attending to such details during measure development.

Qualitative research has high potential for addressing the aforementioned task issues in order to refine and validate the MPT. Qualitative methods can be used to improve existing assessments by soliciting feedback from members in the population of interest. Moreover, qualitative methods (e.g., focus groups, individual interviews) provide valuable information regarding central issues and concepts to be investigated in subsequent quantitative research (Neale, Allen, & Coombes, 2005). MPT formats and instructions have been designed by researchers (Aston et al., 2015; Collins et al., 2014), thus such measures may not accurately reflect language and concepts traditionally used and understood by regular cannabis users.

Focus groups are well suited for measure development and improvement as group discussions with regular users of cannabis can reveal participant comprehension of instructions, provide opportunity to discuss key terms and appropriate language, and elucidate multifaceted concepts that may not be reflected in the current measures. Relatedly, cognitive interviews are ideally suited to evaluate measures intended to assess demand for cannabis. Cognitive interviewing may be used to evaluate instructional set and survey item comprehension. This technique appreciates that the process by which individuals respond to questions can be complex, and comprises several cognitive steps including question comprehension, memory retrieval of pertinent information, compiling and integrating information from memory in order to decide about answering, and then ultimately planning a response (McNeely, Halkitis, Horton, Khan, & Gourevitch, 2014; Willis, 2005). Some qualitative research has been conducted with regular cannabis users (Goodman, Leos-Toro, & Hammond, 2019; Schauer et al., 2016), however, no studies have specifically evaluated behavioral economic drug purchase task measures. Utilizing feedback obtained with qualitative methods is essential to properly inform development of a valid and reliable measure of cannabis demand that will be effective across diverse modes of administration, use contexts, and amount commonly purchased.

The current investigation employed a qualitative approach in two phases to identify strategies to improve the MPT. During Phase I, focus groups were completed with frequent regular cannabis users to identify strategies to optimize the MPT. Qualitative and quantitative data were collected on cannabis use patterns, purchase behavior, and cannabis demand, and feedback was solicited to effectively modify the marijuana purchase task. During Phase II, cognitive interviews were conducted with frequent regular cannabis users to evaluate task modifications and assess user comprehension.

Phase I

Participants

Regular cannabis users were recruited in 2016 from the community in Rhode Island and Massachusetts via flyers and social media websites to participate in focus groups (5 groups; 6-7 participants per group; total $n = 31$; 28% female; median annual individual income bracket: $10,000 – $19,999). Participants met the following inclusion criteria: native English speaking, 18-50 years of age, not seeking treatment for cannabis use, cannabis use at least 4 times in the past month on average and at least monthly for the past 6 months, and purchase of cannabis at least twice in the past 6 months. Participants were excluded from the study if they reported having obtained a medical cannabis registration card. Individuals with a medical cannabis registration card were interviewed as part of a separate study not presented here due to differences in cannabis access, cost, and legal ramifications.

Procedure

Study procedures were approved by the Institutional Review Board of Brown University and all participants provided informed consent prior to study participation. Participants completed self-report measures including a demographic information, the Marijuana History and Smoking Questionnaire (Metrik et al., 2009), and a Marijuana Purchase Task (Aston et

al., 2015) before engaging in the focus group discussion. Focus groups were moderated by the study principal investigator (EA) who was accompanied by a research assistant trained in note-taking. Group discussions followed a semi-structured agenda designed to collect information from participants on evaluation of and suggested modifications to the MPT. Other data not presented here pertaining to cannabis use and purchase behavior were collected as well. Focus groups were digitally recorded and captured in observational notes. Debrief summaries were conducted immediately following completion of each group discussion. Discussions lasted between 67 and 81 minutes (mean = 76 minutes). Participants were compensated for participation.

Measures

Participants provided demographic information and completed the *Marijuana History and Smoking Questionnaire* to assess age of onset of marijuana use, typical cannabis use quantity, typical mode of self-administration, amount of money spent monthly on cannabis, and other questions related to cannabis use patterns (Metrik et al., 2009). Participants also completed the original *Marijuana Purchase Task (MPT)* measure (Aston et al., 2015). The MPT measure was developed to assess behavioral economic cannabis demand and was based on Jacobs and Bickel's (1999) original procedure and validated for alcohol (Murphy & MacKillop, 2006) and tobacco (MacKillop et al., 2008) purchase tasks. Participants were provided with an instructional vignette describing stipulations associated with hypothetical purchasing and consumption of cannabis (i.e., number of hits one would purchase for use in on a typical day at prices ranging from $0–10/hit; see supplemental materials). Five metrics of cannabis demand were obtained from the MPT: breakpoint, intensity, elasticity, P_{max}, and O_{max}.

Data Analysis Plan

An executive summary of each focus group was made via review of MPT section of the audio recording for each focus group. Key topics were summarized by a research assistant who was not involved in decisions regarding changes to the MPT. Illustrative quotes were subsequently selected to reflect each theme. The research team met and reviewed the executive summaries. A list of concerns with the MPT was generated and used to develop a refined MPT measure.

Indices of cannabis demand were calculated from performance on the original MPT to confirm that the sample included in the current investigation reported similar levels of demand compared to those described in previous research (Aston et al., 2015). Observed values for breakpoint, intensity, P_{max}, and O_{max} were estimated by directly examining MPT performance. Price elasticity was generated by fitting individual curves in GraphPad Prism using the exponentiated demand equation (Koffarnus, Franck, Stein, & Bickel, 2015), $Q = Q_0 \times 10^{k(e^{-aQ_0C}-1)}$, where Q = quantity consumed, Q_0 = derived intensity, k = a constant across individuals that denotes the range of the dependent variable (cannabis hits), C = the cost of the commodity, and a elasticity or the rate constant determining the rate of decline in consumption based on increases in price (i.e., essential value). The appropriate k value was determined by subtracting the $\log_{10}$- transformed average consumption at the highest price ($10.00) from the $\log_{10}$-transformed average consumption at the lowest price used in curve

fitting ($0.25). The k value used in analyses was 1.471. An R^2 value was generated to reflect percentage of variance accounted for by the demand equation (i.e., the adequacy of model fit). All responses exceeding 99 hits at any cost were recoded as 99 in an effort to compare purchase task performance in the current study with performance on a previously validated version of the MPT wherein consumption was capped at 99 for biological plausibility (Aston et al., 2015). Demand analyses were conducted using GraphPad Prism 7.

Results

Preliminary analyses

Demographic, cannabis use, and demand variables are presented in Table 1. Four participants showed evidence of constant demand (i.e., invariant responding across prices) or low effort on the MPT (e.g., inconsistent responding across prices) and were excluded from subsequent behavioral economic analysis. Raw MPT data were examined for outliers using standard scores, with a criterion of $Z = 3.29$ to retain maximum data. A small number of outliers were detected (14 outlying data points; 2.4%). Of the outliers, 13 occurred in data from one participant at the 13 highest prices ($2.50 – 10), and 1 occurred in data from one other participant ($2). Original raw data (hits) at these prices were 50, 30, 30, 30, 25, 25, 25, 25, 25, 25, 20, 20, 15, 15. The outliers were determined to be legitimate high-magnitude values and were recoded as one unit higher than the next lowest non-outlying value as follows: 31, 21, 21, 21, 21, 21, 21, 21, 21, 21, 11, 11, 11, 11 (Tabachnick & Fidell, 2000). Figure 1 (left) illustrates the mean number of cannabis hits participants reported they would consume at 22 prices. Cannabis consumption generally decreased as a function of increasing price. Figure 1 (right) depicts the expenditure associated with each price. The exponentiated demand equation provided an excellent fit to the overall demand data ($R^2 = 0.99$) and a very good fit to the individual data (median $R^2 = 0.89$, interquartile range = 0.83–0.96).

Qualitative themes

Four principal themes emerged during focus group discussions concerning areas for improvement in the original MPT measure, each described in detail below: unit of cannabis purchase, cannabis quality, time duration specified for use, and unit price. A summary of themes and subsequent modifications to the MPT following focus group completion is presented in Table 2.

Unit of marijuana purchase

Concerns with employing "hits" as the unit of cannabis purchase: Participants in all focus groups disliked use of the term "hits" as the unit of cannabis purchase on the MPT. Overall, they found the term inappropriate for assessing cannabis cost, saying things like, *"I have no idea how many hits I would take off a joint…I've never counted"* (#4). Many participants expressed confusion with the conversion of their typical administration mode to hits. Other participants stated that, *"I would never measure marijuana by the hit"* (#10) and *"Hits? I can't put a price on a hit"* (#11). Participants perceived the term to be *"random"* (#19) and explained that hits are *"not associated with the buying process at all"* (#9). One participant explained that when interacting with a dealer, *"you would never buy a—a sack of weed and ask, 'How many hits is that—would that be?'"* (#12). Some participants provided

additional explanation regarding why hits is not an optimal unit of measure for cannabis because hit size tends to vary as a function of administration mode. One participant stated, *"I could not tell you how many hits I've taken…so, like, for instance, if I pack my bong, I might get six hits out of it, but I packed a bowl, I might get ten hits"* (#31). One participant indicated that hits *"sounds like hardcore drugs"* and suggested employing the term *"puff"* as it is more *"user friendly"* (#22).

Grams as optimal unit of purchase: Overall, participants suggested using weight (e.g., grams) as the unit of purchase on the MPT as it is typically the unit used in the buying process. They explained that use of weight transcends administration mode. One participant said, *"I think the easiest way would just to be going by, like, weight because…anybody can choose what weight they're smoking. If you're smoking 0.5 out of a bong, it's still 0.5 out of a bong. It's 0.5 out of a joint. It's 0.5. Like, it's not gonna change"* (#4). Another participant indicated that hits are, *"not the best metric 'cuz most people don't think about like how much it's gonna cost per hit. They're thinking about how much it costs per gram"* (#28). Participants stated that, *"it would make more sense to maybe ask by the gram or something…a gram is the best base unit. The most universal one"* (#9). Another participant suggested that the MPT instructions, *"should go, "How many—how many grams would you say you buy in a week?"* (#10).

Cannabis quality

Concerns with pre-designating cannabis quality: The majority of participants agreed that it may be problematic to specify quality on the MPT. In general, there is no stably "average" quality cannabis in their geographic area, though they clarified this determination by citing some unique circumstances wherein the quality drops (e.g., on college campuses, during a "drought"). Overall, participants agreed that high quality cannabis is typically available. Participants explained that designating the cannabis available for purchase on the task as "average" may impact responses. One participant said, *"Yeah. That kind of affected [it]…if you put average…as between…the best weed and…the worst weed…that's still some pretty bad weed. So…generally, I wouldn't even buy that bad weed. I would just, like, not smoke"* (#4). Other participants commented, *"average quality sounds like worse than what I would usually expect"* (#26) and, *"yeah, don't say average"* (#27). Another participant explained that cannabis quality in their state may differ from that of the rest of the country, describing average quality cannabis as being, *"impossible to get around here now"* and *"average quality stuff around here is pretty damn good"* (#28). In contrast, one participant explained that average, *"can appeal to anybody because your average might not be the same as my average"* (#10). While some participants suggested specifying, *"percentages of how much THC's inside of it"* (#27) or *"good quality and strength"* (#26), others countered this by explaining that good or high quality may be too ambiguous. One participant said, *"Once you say, like, "good quality," it becomes…"Oh, like, what's the best that you ever had?" or…something I can't imagine and, like, what would I pay for that amazing thing? And…it gets complicated"* (#9). Another participant explained that specifying high quality might impact cannabis demand, explaining that, *"if it's high-quality, it's gonna influence what I feel, like people take more than they normally would"* (#21). Many participants agreed that cannabis quality should be tailored to the individual user on

the MPT. Participants indicated that the instructions should, *"phrase it like the quality that you're used to"* (#21), and explained that the MPT should specify, *"the typical quality that you buy"* (#28). Another participant summarized the suggestion well, saying, *"everyone here probably uses different strains, different varieties, different qualities and everything, so it's like what you are used to, like your typical"* (#29).

Time duration specified for cannabis use

Concerns with asking about cannabis use over a typical day: Many participants indicated that the time duration designated on the MPT (i.e., a typical day over the last month when you would use marijuana) was too general. One participant said, *"For me the main problem was I don't know if I understood what 'on a typical day' meant. So my question is, is that a typical day in general, or a typical-typical day where I've already decided that I wanna smoke? Because those would be very different answers"* (#26). That same participant went on to explain why this phrasing may make the task more difficult to complete for less frequent cannabis users because, *"that's very hard to answer for people who don't use it a lot. Because then I would have to do math. If I don't use it every day, I have to do math in my head. Say I use it only a couple times a month, or even just a couple times a week, then I have to divide that through…And that would be very hard for me."*

Concerns with requiring that all cannabis be used immediately: Overall, participants expressed concern with the requirement that all cannabis purchased on the MPT must be consumed immediately within the specified time duration. One participant explained this sentiment by saying, *"An issue that I had is that…I don't buy weed just to smoke all of it right then and there. I'll buy a set amount and then smoke that over a period of time. So having to think, now I have to smoke, just—will buy just an amount that I'm gonna smoke right then and there, it's like, sort of tricky for me to make that conversion in my mindset about buying"* (#1). Another participant raised similar concerns about less frequent users and said, *"I mean I know that you have these conditions. One of them was you have to consume it all. I was assuming like the same day, I guess. That would pretty much exclude me from-from putting my amount here because I keep it for later occasions. So I don't know if that's what you want to measure, but that's how it would turn out for me"* (#26). The majority of participants stated that they typically purchase enough cannabis to last for some extended period of time, usually one or two weeks, and rarely purchase cannabis to use immediately. The requirement that all cannabis purchased must be used "immediately" appeared to reduce desire to use cannabis for many participants. This was particularly true for less frequent, non-daily users.

Cannabis price

Aspects of purchasing cannabis hits at increasing levels of price: Some participants commented on the price ranges associated with hits that were designated on the initial MPT. One participant described his experience with the MPT by saying, *"I mean… after a dollar, I just said zero for everything because at that point, it would be too much to even—it would be too pricey, and it wouldn't even get me high"* (#3). Another participant expanded on this comment, explaining a situation wherein one might be willing to pay more for a hit, indicating, *"I don't think anyone would ever go as far to pay like $1.25 for a hit.*

Maybe like $1.00 if like you really needed it, if you were in that like dire situation like at a music festival or in a place you've never been and like I need weed" (#13). One participant commented that a *"desperation factor"* became evident at high prices on the task (#19). In this regard, another participant echoed a similar feeling of desperation, explaining that they were willing to pay high prices for cannabis because they use it for medical purposes and *"need it to…function and it's that or…prescription drugs—so I don't care how much"* (#29).

Altering MPT prices to align with purchase of grams: Participants indicated that MPT prices should be altered to reflect changes made to a common unit of cannabis purchase (i.e., grams). Virtually all participants were familiar with the typical cost of cannabis per gram. One participant explained that a gram is generally the smallest unit of purchase available, indicating that, *"right now, the least—the lowest amount most people would buy is a gram cuz that's ten bucks, and like most dealers aren't gonna sell you a 0.5 cuz that's just way too much trouble"* (#28). Several other participants described the range of prices per gram that one might encounter in Rhode Island and Massachusetts, and subsequently explained how this range should be reflected on the MPT. One participant said, *"So you could start…$10.00, and then once you get up—I don't know. I mean, I've paid, like, $30.00 for a crazy medicinal gram, but, like, that's the most I would ever pay. So, like, I wouldn't go too—too much higher than $40 per gram"* (#10). Another participant suggested querying the participants about their typical mode of administration and suggested incorporating administration mode into the task, *"Give them an option, be like, do you typically smoke out of, like, blunts, bowls, joints, whatever? And be like, how much would you pay for, like, one bowl pack, two bowl packs, or like, even half bowl packs, half joints, stuff like that?"* (#4). Overall, participants agreed that price points should realistically align with typical price per gram for cannabis in the US New England region.

Phase II

Participants

Regular cannabis users were recruited in 2017 from the community in Rhode Island and Massachusetts via flyers and social media websites to participate in cognitive interviews (*n* = 20; 50% female; mean (*SD*) age = 28 (8); median annual individual income bracket: $10,000 – $19,999). Exclusion criteria were identical to those presented in Phase I.

Procedure

Study procedures were approved by the Institutional Review Board of Brown University and all participants provided informed consent prior to study participation. Participants completed self-report measures before completing the cognitive interview. Cognitive interviews were conducted by the study principal investigator (EA) who was accompanied by a research assistant trained in note-taking. Interviews were intended to assess acceptability and comprehension of an MPT measure developed and refined following Phase I of this research (see Table 2 for modifications to the MPT following Phase I completion). Initially, participants were asked to "think-aloud" as they completed the MPT. Thinking-aloud was demonstrated by the principal investigator, and then practiced by participants. Subsequently, for each point in the instructional set, comprehension was assessed.

Participants were asked to explain the purpose of each instructional element in their own words and convey any potential points of confusion. Interviews were digitally recorded and captured in observational notes. Summaries were completed immediately following each interview. Interviews lasted between 15 and 38 minutes (mean = 24 minutes). Participants were compensated for participation.

Measures

Participants completed identical measures to those presented in Phase I, with the addition of the modified MPT presented herein.

Data Analysis Plan

Participant dialog regarding each component of the instructional set and task was transcribed and summarized across interviews. The interviewer (EA) documented the type and frequency of comments raised about the task. Dialog pertaining to each aspect of the instructional set focused on opinion, comprehension, or personal experience completing the MPT. An interpretivist analytic approach was employed (i.e., emphasis on participants' interpretations and experiences (K. Miller, Chepp, Willson, & Padilla, 2014), allowing the researchers to refine components of the instructional set based on individualized feedback (e.g., a participant's misunderstanding of a key instructional aspect) and disparate interpretations reflecting ambiguity. Based on guidelines from previous research suggesting that sample sizes of five to 15 participants are sufficient for cognitive interviewing (Willis, 2005), an initial sample of 10 participants was recruited. Participants completed cognitive interviews using the version of the MPT modified following Phase I of this research. An executive summary of each interview was made and illustrative quotes were selected regarding each aspect of the instructional set. Subsequently, minor modifications were implemented based on feedback pertaining to the first iteration. An additional 10 participants were then interviewed, and theoretical saturation (Morse, 1995, 2000) was determined to have been met owing to repeated recurrent responses.

Demand indices were generated from the refined MPT with identical formulae to that presented above. The k value used in analyses was 1.523. An R^2 value was generated to reflect percentage of variance accounted for by the demand equation.

Results

Preliminary analyses

Demographic, marijuana use, and demand variables are presented in Table 1. Raw MPT data were examined for outliers using standard scores, with a criterion of $Z = 3.29$ to retain maximum data. A small number of outliers were detected (5 outlying data points; 1.3%). All 5 outliers occurred in data from one participant at the 5 highest prices ($40, 45, 50, 55, 60). Original raw data (grams) at these prices were 13, 13, 12, 10, 10. The outliers were determined to be legitimate high-magnitude values and were recoded as one unit higher than the next lowest non-outlying value as follows: 6, 4.5, 4.5, 4.5, 4.5 (Tabachnick & Fidell, 2000). Figure 2 (left) illustrates the mean number of marijuana grams participants reported they would purchase at 20 prices. Cannabis purchase generally decreased as a function of

increasing price. Figure 2 (right) depicts the expenditure associated with each price. The exponentiated demand equation provided an excellent fit to the overall demand data ($R^2 = 0.96$) and a very good fit to the individual data (median $R^2 = 0.86$, interquartile range = 0.80–0.93).

Qualitative themes

Task overview with picture.—At the beginning of the MPT discussion, participants were queried about the reference picture in the instructional vignette (see supplemental materials). Many participants found the picture to be helpful in reminding them about cannabis gram size, particularly for users less "*familiar*" (#8) with purchasing and those who "*consume quite casually*" (#10). One participant stated "*I never knew that a gram was a bottle cap full*" (#2), and another participant explained "*for someone that wouldn't know about weed…it would…give them [an] idea of what a gram might look like*" (#3). However, some participants indicated that the bottle cap reference was "*weird*" and "*random*" (#9). Participants discussed the fact that "*density*" can greatly impact size (#13, #15) and explained that "*different kinds of marijuana are different sizes because some of it's more condensed or it weighs heavier, some are lighter*" (#5).

Purchase timeframe.—The instructional set next designates the timeframe for cannabis purchase and consumption as one week, and participants were asked about the appropriateness of this timeframe. The majority of participants endorsed this timeframe and indicated that it mapped on quite well with their own purchasing patterns. Participants commented "*a week is perfect*" and a "*month is too long*" (#17, #19). Other participants agreed, explaining "*my friends and I tend to buy for a week amount*" (#1). One participant commented on their thought process, stating "*I think about buying weed in terms of how long will this last me…probably a week or something*" (#9). Participants also explained that longer timeframes might exclude less frequent users. One participant said "*anything more than a week you would be like knocking out all the people that are casual users because it would be hard to get down to that small fraction*" (#10). When comparing this modified timeframe to that used in the original MPT version, one participant summarized the general sentiment conveyed during interviews, explaining "*I think it's harder for a day [as in the previous MPT] because there are some days when I don't smoke and some days when I do smoke more. So…a week is helpful because that allows for more variation…within a typical week there might be 3-4 days when I use weed and…2-3 days when I don't*" (#12).

Cannabis source.—The MPT vignette continued by instructing participants that they could only obtain marijuana from the current source and were not permitted to use any saved product. Participants conveyed their understanding that this was not "*a situation where it's too expensive so you find somewhere else*" (#1). Several participants discussed the fact that the MPT is assessing "*desperation*" in escalating the price (#1). One participant paraphrased this instruction by saying "*you have to buy from that source so there's no other options*" (#4). This differs from typical purchasing habits, as "*usually when you're purchasing marijuana from different sources you can compare prices of how much each person is selling*" (#4). Some participants talked about having experienced similar situations in real life during which the majority of sources were "*dry*" and they were unable to find a good

deal (#14). Participants also conveyed some understanding about the concept of breakpoint, indicating that the MPT "*kinda puts you in that predicament so…you…have to buy from that person…you…spend more than…you normally would, but at the same time, you ain't tryna go broke over some weed*" (#16).

Typical budget.—Participants were next instructed to assume they had access to their usual disposable income when making MPT decisions. Overall, participants understood that they had their usual "*expendable cash…per week*" (#12) or "*the money that I always have available to purchase marijuana*" (#8). One participant explained "*I know what my budget is for the week for [marijuana]. It's budgeted in there just like bills*" (#16). Another participant conveyed that they had made adjustments to their hypothetical budget due to their current financial situation, and stated "*I wouldn't be buying that much weed right now because I'm pretty broke…I wouldn't pay for that because I'm broke right now*" (#9). Some participants were less constrained by this instruction, potentially reflecting an income effect. For example, one participant commented "*that was a little hard for me because I don't have…a set amount of money [to] spend…on weed. If I happen to smoke a little bit more, I'll spend a little bit more*" (#17). Moreover, while the majority of participants understood the budget constraints, a few found the instruction somewhat confusing and explained "*it was a little unclear whether the typical amount of money referred to how much money you personally have or…the typical amount of money that people have in general*" (#13). Finally, some participants again conveyed understanding of the concept of breakpoint, explaining that high price "*factors into people's standards…like I will never pay 50 dollars for an 8th because I would never do that…even if I had the money to and I needed it…there's this part of me that's just ingrained like you can't pay 50 dollars for an 8th*" (#9).

No immediate prior substance use.—The vignette next asked participants to assume they had not used marijuana or other substances prior to completing the MPT, the intention being that participants would assume they were not under the influence while completing the task. Some participants understood the intention of this point, explaining "*I think some people who have already been smoking might be more inclined to continue, whereas some people…might feel less inclined because they've already smoked for the day and…don't care as much*" (#1). Other participants indicated that "*using marijuana or drugs will alter your perceptions so you might just want to buy*" (#9) and "*if I'm high I still want to buy for future use…I wouldn't be like I'm already cooked*" (#4). Still other participants provided support for this instructional set, stating they understood that "*you're sober before making these decisions*" (#19) and "*you're thinking straight*" (#18). While many participants understood the intention of this instruction, several others interpreted this point very differently, taking it to mean the task should be completed as if the individual had never purchased or used cannabis previously. One participant said "*I would assume it means ever before*" (#13) and another explained that it was very difficult "*assuming that I wasn't a marijuana user or I did not use marijuana…to me it's…telling me that I've never smoked before*" (#15).

Inability to use marijuana elsewhere.—Participants were subsequently instructed that they would not have the opportunity to use marijuana elsewhere after completing the MPT. Most participants clearly understood this point, conveying that "*I'm not considering the fact*

that I might be going to a party later that night and marijuana might just be available to me…this is my only chance for the day" (#1). Other participants paraphrased this instruction by stating *"you gotta get it right then and there"* (#3) and understood that they *"wouldn't have the opportunity to smoke with anybody else or to go to anybody else's house and smoke"* (#8). The instruction was intended to create an isolated purchasing environment for cannabis. Comprehension of this point was clear among participants, one saying *"I would buy it if I knew I didn't have an opportunity"* (#11) and another explaining *"this is your only source and you either get from this individual or you're not getting high at all"* (#13). The requirement was well-paraphrased by another participant, who explained *"it's a situation that we're given…we can't manipulate it to…reflect some sneaky thing…that would kind of defeat the purpose"* (#14).

Must consume all purchased marijuana.—The next MPT requirement stated that participants were to assume they would have to use all marijuana they purchased. Participants understood this instruction, explaining *"you have to smoke it all that week… realistically…for free, I put more than I would generally smoke only because if someone was giving me that much marijuana for free I would probably take a little bit more and probably get higher than I normally do for that week"* (#18). Another participant stated *"my first thought when I saw the numbers was like oh it's free I would just put 999* [maximum], *but you have to think realistically about how much you actually use"* (#14). Importantly, other participants explained that this instruction altered their demand as it caused their purchasing to deviate somewhat from their typical patterns. One participant explained *"that was probably the most significant point for me because I tend to save…I don't tend just to buy to use at that one moment but…since it was a week I was able to visualize a little better"* (#1). Another participant agreed that it is difficult to purchase cannabis to use at that moment, stating *"you probably wouldn't consume all of it all in one sitting but if you had the opportunity to get it, you're gonna get it"* (#3). Another participant summarized these sentiments by explaining that *"people have their own habits when they smoke weed…like buying weed and then saving it for later. It's not like they're buying this and then consuming it in…one sitting"* (#9).

Typical quality and strength.—The MPT next indicates that the participant should assume the marijuana available for purchase is similar to the quality and strength of marijuana that they typically use. Overall, participants understood this instruction, conveying their comprehension by saying *"it's like the same grade as what I'm used to smoking…not weaker, not stronger"* (#5), that it *"just means your normal weed"* (#18), and *"it would be the same like if I bought it from the same person"* (#7). Other participants appreciated this point about quality, saying *"it was easier for me to think about because I know what to expect when I smoke the weed that I buy so I went with that train of thought"* (#1). Others explained *"now a lot of people don't buy regular grade so I think that's more clear. I was able to think about what I normally buy"* (#2). Still other participants explained why the typical cannabis quality specification was an improvement over average or high quality because *"I know that I'll always be able to get really really good weed, so if someone comes up to me and they offer me weed that's bad I just won't buy it"* (#10). One individual explained *"good weed for some people might not be good weed for others…depending on*

where you're from and how experienced you are smoking" (#13). Another participant summarized the general sentiment about quality, indicating that *"similar quality is better because that lets me use my own experience as the baseline as opposed to…I don't know what quality weed other people are smoking…it's harder to place the weed that I get in comparison to the weed that everybody else in the rest of the world is getting…I just know that this is what works for me"* (#12).

Maximum amount of purchase.—In the first set of ten cognitive interviews, the maximum amount of cannabis available for purchase at any price was capped at 28 grams or approximately one ounce. Participants were queried about the cap, with one participant indicating *"for personal smoke use, an ounce is fine for a week"* (#3). Another participant stated "*I thought that was a lot, like I don't know anyone who smokes one ounce by themselves in a week…I know people who buy ounces on a regular basis but they're definitely sharing"* (#1). Others commented *"for me that's definitely high enough…I know others that buy two ounces but I don't know if they've smoked all that by themselves or with others"* (#4). However, other interviewees started to indicate that 28 grams may not be high enough. One participant explained *"I guess it's high enough…but I know there are people that are even smaller than me that could use that"* (#5). Another participant echoed this opinion, suggesting that *"there could be other people that do smoke more than that…an ounce for one person is a lot in a week…but I do know people that probably smoke more than that"* (#8). In response to these points, and in an effort to remove any unintentional suggestions about normative purchasing amounts that might result from a low cap, the cap was raised to 99 grams for the subsequent ten interviews. Individuals commented *"for personal use I don't think anyone's buying more than 99 grams"* (#13). Another participant stated *"I feel like the cap could probably be below that but I feel like that's a good stopping point…allow room for it"* (#14). Still others conveyed agreement with the updated cap, saying it is *"possible for someone to smoke 99 grams in a week"* (#16) and *"I think 99 is fine…even for Snoop Dogg that should be good"* (#18).

Purchase for personal use only.—The final MPT instruction concerned the clarification that all marijuana purchased on the hypothetical task was for personal use and would not be shared with others. This point was easier to comprehend for individuals who usually smoke alone, but was substantially more difficult for those who tend to purchase and smoke with others. One participant explained *"I always smoke by myself anyways so it was fine"* (#3) while another explained *"I've never really gone to buy weed just for myself without any expectation to be smoking it later with someone else…so I did…some simple division…I definitely deliberately thought about the difference"* (#1). Another individual suggested *"I think you should maybe have a point about like sharing weed because I think how much people purchase depends on how often they are smoking people up"* (#13). While most understood that this instruction was solely pertaining to purchase and use, others misunderstood the intention and thought it pertained to the hypothetical MPT environment. One participant specified *"to me, that just meant smoking alone"* (#8). Another suggested that the language be modified to say *"whether you're with people or alone, assume this is for your personal use"* (#19).

Final instructional vignette.—After integrating all feedback from Phase I and II, a finalized instructional vignette was developed as follows:

> On the following page you will see a number of questions that ask how much marijuana you would use at different levels of price…At each price, choose how many GRAMS you would use…over A TYPICAL WEEK (7 DAYS). Assume that you can only get marijuana from this source. You can't go to a different source for cheaper marijuana and you cannot use any marijuana you may have saved. You have the typical amount of money available to you to purchase marijuana. You did NOT use marijuana or use any other drugs right before making these decisions. You will NOT have an opportunity to use marijuana elsewhere after making these decisions. You would use all the marijuana that you purchase. You can't save the marijuana for a later date. The marijuana you will purchase will be similar to the quality and strength of what you typically use. You can only buy a maximum of 99 grams. Whether you are with people or alone, assume this amount of marijuana is only for your personal use…Given the previous conditions, how many GRAMS of marijuana would you use during a TYPICAL WEEK at the following prices: $0, $1, $2, $4, $6, $8, $10, $12, $14, $16, $18, $20, $25, $30, $35, $40, $45, $50, $55, $60?

Discussion

The present investigation represents the first comprehensive effort to refine the behavioral economic Marijuana Purchase Task for assessing marijuana demand. This study aimed to solicit narrative feedback from regular cannabis users on a MPT measure designed to assess demand for cannabis and to subject that feedback to qualitative analysis. Four themes regarding areas for improvement on the MPT emerged from focus group discussions including unit of cannabis purchase, cannabis quality, time duration specified for use, and unit price. In making decisions regarding adapting the MPT, we considered the range and breadth of suggestions reported by participants about their use and purchase behavior. We considered how experience and individual difference might shape task comprehension and aimed to select universally acceptable adaptations when appropriate. Feedback representative of each focus group was evaluated and compiled by the research team and was subsequently used to create a refined version of the MPT. The refined version was subsequently administered and evaluated during individual cognitive interviews. The MPT was subjected to final refinements and is presented herein.

Across focus group discussions, participants reported disliking the term "hit" as the unit of cannabis purchase and use on the MPT. As cannabis is rarely purchased in hits, the term is not associated with the buying process. In addition, the majority of participants reported difficulty with determining number of hits taken during a typical use episode. While the term hits was initially chosen for higher resolution in terms of range and because it was thought to span across cannabis administration modes, it was revealed that administration mode impacts hit size, and thus does not transfer effectively across various methods of use. When presented with hits, participants did not typically understand this to mean that they should convert their own typical unit to hits, rather they interpreted the instructions to mean that

they must purchase in hits, which was perceived to be unusual. According to participant feedback, grams appear to be an ideal unit of purchase and use for the MPT, effectively spanning administration mode and presenting with familiar and relatable price points. Participants largely agreed that replacing hits with grams as the unit of use and purchase on the MPT would greatly improve the task. Agreement with the decision to utilize grams as the unit of purchase was echoed across cognitive interview participants, who agreed that the real-world unit of purchase should be a central component of the task.

It was suggested that cannabis quality be tailored to the individual user rather than ambiguously labeled as average in the MPT instructions. Many participants perceived average quality to be very poor compared to cannabis that is typically available for purchase, which ultimately impacted their demand. Similarly, participants explained that specification of high quality likely impacts demand as well, thus asking about typical quality of cannabis purchased and used by participants will facilitate more accurate assessment of cannabis demand. Indeed, a recent study showed that cannabis demand is significantly impacted by cannabis quality (Vincent et al., 2017). Modifying the MPT language aligns well with instructions used in the alcohol and cigarette purchase tasks. Cognitive interview discussions reflected agreement with this change, including issues with specifying quality as average or high quality.

Participants agreed that the time duration specified for use of cannabis on the task was vague, and it was suggested that the time period be extended to better correspond with purchase of grams. The original task designated the time duration as "a typical day over the last month when you would use marijuana," and participants reported that this was too broad. This time duration generated some confusion for non-daily users as well. Moreover, recent research suggests that time period specified in purchase task instructions can significantly impact demand, with demand increasing with duration of substance access (Kaplan et al., 2017). As participants suggested that unit be changed to grams, the time duration for use needed to be greatly expanded to prevent a ceiling effect. Cognitive interview discussions reflected agreement with alterations to the instructions to permit cannabis to be purchased for use over a typical week, with participants pointing out that this length of time is more amenable to frequent and casual users alike.

In both Phases of this research, participants commented that it was very difficult to place a price on a hit as hits are never associated with the buying process. Thus, it became difficult for them to ascertain the amount of cannabis in a hit and what an inexpensive versus expensive hit would cost. In the end, participants were firm regarding their opinion that researchers need to ask about prices in terms of a commonly used unit to remove uncertainty and increase ecological validity, and that these prices should align with accurate price per gram in the New England region. Importantly, prices on subsequent MPTs should be adjusted according to geographical location, as price per gram varies in response to origin, quality, and legal status in state of sale. Participants also suggested that administration mode be incorporated into the task. While this is not typically done with currently used substance purchase tasks (e.g., alcohol, cigarettes), it is certainly a valuable area for further research as numerous administration modes and cannabis formulations are being developed, sold, and adopted across the country (Borodovsky et al., 2016).

There are several limitations to the current research of note. Thus far, MPT research, including the current study, has recruited relatively heavy cannabis users for study participation. Indeed, the demand indices in the current study were moderately higher than those in samples from previous MPT work (Aston et al., 2016, 2015; Collins et al., 2014; Metrik et al., 2016), and higher cannabis use frequency may have contributed to this. Subsequent research should assess demand for cannabis among users with a diverse range of use level and frequency to increase generalizability. In the current qualitative research, individuals who reported possession of a medical cannabis registration card were excluded from participation due to differential access to cannabis and legal ramifications for use and purchase. However, over fifty percent of the sample still reported using cannabis for medical purposes at least occasionally. It is possible that individuals who use cannabis for medical purposes have different motives for use, and ultimately may exhibit divergent cannabis demand patterns. For such users, cannabis is used to treat an ongoing medical issue, and is therefore perceived to be a necessity. In this regard, the user may be willing to pay significantly greater prices. Future research should also examine demand in individuals who are eligible or choose to use cannabis for medicinal purposes. Relatedly, several recent studies classify users based on using primarily for medical or recreational purposes (Gunn, Jackson, Borsari, & Metrik, 2019; Loflin, Earleywine, & Bonn-Miller, 2017; Metrik, Bassett, Aston, Jackson, & Borsari, 2018). However, it is likely that many individuals use cannabis for both recreational and medical purposes depending on context, environment, peers, and the presence of medical symptoms. Subsequent research should aim to disentangle potential differences in cannabis demand based on recreational or medical reasons for using. Finally, the updated MPT has not yet been validated in a large representative sample of current cannabis users. Validating this new measure will be an essential step in this line of research.

A state version of the original MPT has been administered in previous research and is sensitive in detecting cue-elicited changes in cannabis demand (Metrik et al., 2016). It is important to note that the revised trait MPT measure presented herein is not appropriate for use in studies investigating phasic changes in demand for cannabis due to the use of grams as the unit of purchase and the specification that cannabis may be purchased for use over a one-week period of time. In this regard, some research indicates that daily cannabis users typically roll joints that hold less than 0.5 grams of cannabis (Freeman et al., 2014), therefore it is less common for individuals to use more than a gram of cannabis within a single use episode. Consequently, grams as the unit of purchase and use is likely too large for assessing hypothetical immediate use of cannabis in a state-related paradigm. Alternatively, marijuana puffs may be a good unit of measurement for state assessment of cannabis demand as users may be able to accurately report how many puffs they would take in a short, clearly defined time period. Relatedly, cannabis joints may be an effective unit for experimental or ecological studies intending to assess phasic alterations in demand, and has been used effectively in previous experimental research (Collins et al., 2014). However, issues may arise when assessing demand in less frequent users, as such users tend to use comparatively small amounts of cannabis, and thus may not smoke an entire joint in one session. The appropriate unit for research that assesses state changes in cannabis demand is an area for future study. Moreover, no MPT study has been linked to immediate outcomes

(i.e., responding linked to subsequent matched cannabis available in the laboratory) as has been completed with alcohol (Amlung, Acker, Stojek, Murphy, & MacKillop, 2012). Ongoing research from our group intends to link MPT responding to immediate outcomes as this is a key step in confirming measure validity.

Behavioral economic approaches to the study of maladaptive cannabis use emphasize that perception of high relative substance value, despite elevated cost and risk for consequences, is a key determinant of use. As a result, valid measures for quantifying drug reinforcing value are essential for investigating hypotheses within this framework. Development of the refined MPT in this investigation was the culmination of a comprehensive assessment of variables surrounding purchase of a substance with mixed illicit status. Cannabis consumption and purchasing are heterogeneous and multifarious in nature, involving consideration of a multitude of factors including consequences, availability, variety, price, and quality, among others. Utilizing grams, a real-world unit of cannabis purchase, and permitting purchase for a week rather than a day, will improve accuracy of the demand indices. Cannabis demand will more accurately map on to real-world use and purchasing patterns, effectively increasing ecological validity. In this regard, the refined purchase task is anticipated to allow for more precise assessment of cannabis demand and, in turn, enhance a wide array of subsequent studies, including demand as a determinant of cannabis misuse, cannabis taxation policy, and how cannabis demand shifts during co-use with other substances such as alcohol, nicotine, and opiates.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments:

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Public Significance Statement: This investigation employed qualitative methods to refine the behavioral economic marijuana purchase task (MPT). Findings suggest that qualitative techniques can be highly informative for behavioral economic measure development, particularly for substances with inconsistent legality and regulation.
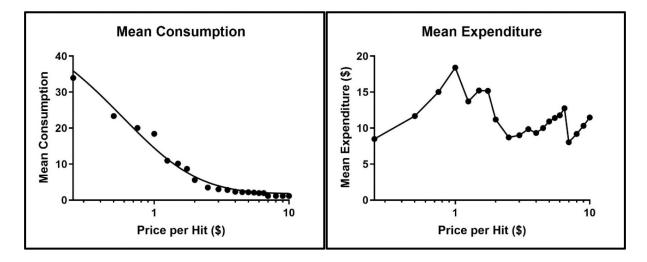
Figure 1.

Focus group demand curves ($n = 27$)

Note. Demand curve for consumption of cannabis hits (left); expenditure curve for purchase of cannabis hits (right).
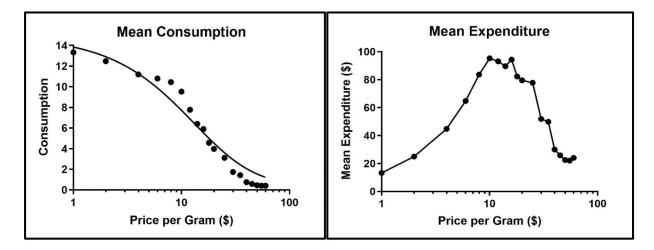
Figure 2.
Cognitive interview demand curves ($n = 20$)
Note. Demand curve for consumption of cannabis grams (left); expenditure curve for
purchase of cannabis grams (right).

Table 1.

Demographics and descriptive variables

	Focus Groups $n = 31$	Cognitive Interviews $n = 20$
	n (%)	*n (%)*
Gender		
Female	9 (29)	10 (50)
Race		
American Indian or Alaska Native	1 (3)	0 (0)
Asian	2 (6)	0 (0)
African American	6 (19)	4 (20)
Native Hawaiian or Pacific Islander	1 (3)	0 (0)
Caucasian	18 (58)	12 (60)
Multiracial	2 (6)	1 (5)
Not Specified	1 (3)	3 (15)
Cannabis used per Week (past month)		
<1.8 grams	3 (10)	3 (15)
1.8 grams	3 (10)	3 (15)
3.5 grams	7 (23)	4 (20)
7.1 grams	9 (29)	2 (10)
>7.1 grams	9 (29)	8 (40)
Daily use of Cannabis	13 (42)	6 (30)
Use of Cannabis for Medical Purposes		
Never	12 (39)	9 (45)
Less than monthly	2 (6)	1 (5)
Monthly	3 (10)	2 (10)
Weekly	3 (10)	4 (20)
Daily or almost daily	11 (35)	4 (20)
Discussed Medical Card with Doctor	2 (7)	5 (25)
	Mean (*SD*)	**Mean (*SD*)**
Age	26.1 (7.2)	28.5 (7.6)
Cannabis use days per week (past month)	5.0 (2.1)	4.8 (2.0)
Age at initiation of regular cannabis use	19.2 (5.0)	18.6 (3.6)
Money spent on cannabis (past 30 days)	129.2 (99.5)	142.0 (146.4)
Indices of cannabis demand	$n = 27$	$n = 20$
	Hits	*Grams*
Intensity	53.89 (40.17)	13.98 (11.32)
O_{max}	30.26 (36.26)	127.35 (166.31)
P_{max}	2.90 (3.11)	13.00 (4.99)
Breakpoint	5.10 (3.85)	30.65 (15.43)
Elasticity	0.02 (0.014)	0.004 (0.004)

Table 2.

Summary of MPT themes from Phase I (focus groups) and subsequent modifications

Major Theme	Original MPT	Participant Feedback	Modified MPT	Rationale for MPT Change
Unit of Cannabis Purchase	Hits	▪Dislike the term hits ▪Number of hits is difficult to calculate; thus data could be inaccurate ▪Uncertainty about how many hits are taken during a typical smoking session ▪Hits is not associated with the buying process ▪Idea of paying for hits is off-putting ▪What constitutes a hit may vary and may be impacted by administration mode	Grams	▪It is easier to estimate amount smoked in grams rather than hits ▪Participants know how much they typically use, but have never counted how many hits they take in a given smoking session ▪Grams are a universal unit of cannabis measurement, and generally the smallest acceptable weight of purchase ▪A picture of a standard cannabis gram should be added to the measure
Cannabis Quality	Average	▪Average quality (i.e., mid-grade) is considered to be poor compared to what is typically available in New England ▪High quality cannabis is usually available and purchased by most users	Typical to the respondent	▪Average quality varies by use level, region, and availability ▪If average quality is considered lower/higher than what the respondent generally smokes, demand will be impacted
Episode Time Period	A typical day over the last month when you would use marijuana	▪Participants report confusion about the typical day specification ▪Participants explain that "typical day" is problematic because they do no generally purchase cannabis to consume immediately, thus the scenario does not map on to real-world purchasing	Typical week over the last month	▪Participants purchase set amount of cannabis and use it over time, typically several days or weeks ▪Participants explain that general smoking routine may include breaks (smoking smaller amounts interspersed throughout the day), thus the requirement that all cannabis purchased must be used at once makes it less desirable
Price	$0 - $10 per marijuana hit	▪Standardized amounts (weights) of cannabis purchase already have average prices, so price ranges should make sense in that context ▪Typical cost of unit (grams) should be task midpoint and the price should increase or decrease from there in set increments	$0 - $100 per gram	▪Cannabis is never purchased in hits, thus it is difficult to understand appropriate price ranges for such a unit ▪Participants know average price per gram for cannabis (i.e., $10-20) thus this should be a range around which to build the task