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Author manuscript

*J Psychoactive Drugs*. Author manuscript; available in PMC 2017 February 16.

Published in final edited form as:

*J Psychoactive Drugs*. 2016 ; 48(1): 56–62. doi:10.1080/02791072.2015.1127450.

## Assessing Sample Bias among Venue-Based Respondents at Medical Marijuana Dispensaries

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### Abstract

Venue-based sampling is the identification of, and outreach to, locations visited by the population of interest for the purpose of collecting data. The method is frequently used to reach specific populations, commonly referred to as “hidden populations.” Medical marijuana users represent a hidden population of persons who use marijuana for medicinal purposes. We examine whether venue-based procedures introduce selection or non-respondent bias into the study.

The venue based sampling procedures employed for the UCLA Medical Marijuana Study used a two-stage, venue-based sampling approach. First, analyses were conducted to assess potential bias within dispensaries that agreed to participate in the surveys. Secondly, analyses were conducted to examine differences among patrons who responded to surveys.

Overall, selection bias was generally absent among study results. Results also illuminated the minimal respondent bias observed among the survey respondents.

Results suggest that the use of dispensaries to access and survey medical marijuana users is a viable option to gather patient information that adequately represents the greater population of medical marijuana users in Los Angeles. Thus, recommendations and conclusions based on findings from venue-based studies of medical marijuana users at dispensary sites serve to impartially inform meaningful research.

### Keywords

sample bias; venue-based sampling; marijuana; dispensaries

### INTRODUCTION

Venue based sampling is the identification of, and outreach to, locations frequently visited by the population of interest for the purpose of collecting survey data (Rothman 2014; Rothman, Gallacher & Hatch 2013). The method is frequently used to reach specific populations that engage in behaviors occurring at low rates in the population at large, commonly referred to as “hidden populations.” (Muhib et al. 2001; Rothman 2014; Rothman, Gallacher & Hatch 2013; Raymond et al. 2010). Reaching hidden populations is sometimes difficult and access to appropriate sampling venues in order to survey the desired

population is often limited (Raymond et al. 2010). Traditional random sampling methods, however, are often inadequate when attempting to collect information from individuals who engage in illegal or socially stigmatized behavior (Raymond et al. 2010). Alternative sampling methods, such as venue based sampling, are often employed as a means to acquire access to information that may otherwise be obscured through traditional randomized approaches. Although these methods may limit generalizability to larger populations, these sampling methods are preferred when attempting to understand a particular phenomenon and knowledge about a specific population is needed (Rothman, Gallacher & Hatch 2013).

Medical marijuana users represent a hidden population of persons who possess and use marijuana for medicinal purposes. The use of marijuana for medicinal purposes has been legal in California since the passage of the Compassionate Care Act in 1996 (CAPCA 2009). Since its passage, dispensaries have opened throughout California with the intention of distributing marijuana to qualified patients. In order to better understand dispensary characteristics and information about patient traits including marijuana use, patient health and purchasing habits, venue based sampling at medical marijuana dispensaries is necessary. However, it is unclear how the use of venue-based sampling procedures may produce biased characteristics of these at-risk populations (regardless of comparison to the general population), especially if these venues themselves market to distinct sub-populations among these at-risk groups (e.g. men, youth, racial groups).

Current best sampling practices posit that researchers should maximize response rates and minimize bias. However, similar to other sampling methods, challenges may arise when conducting two-stage, venue based data collection that impact generalizability of results, particularly when dealing with hidden populations like medical marijuana users (Muhib et al. 2001; Olson 2006). The use of dispensaries in venue based sampling may arouse selection bias and non-respondent bias. Selection bias is a statistical bias in which respondents selected for the study do not adequately reflect or represent the targeted population (Muhib et al. 2001; Olson 2006). Selection bias might occur in two different ways during data collection at dispensaries. First, the venue (in this case dispensaries) may not approve of data collection. Approval from venue owners is necessary to conduct data collection on site. This is especially true for dispensaries given the political climate surrounding them where community support and participation may be skewed. There are often community concerns regarding the presence of dispensaries within neighborhoods related to issues of safety and crime (CAPCA 2009). Consequently, some dispensary sites obscure their presence from the public and evade activities that may draw attention (Graves 2011).

Frequency of venue attendance may also introduce selection bias among patients at dispensary sites, resulting in over-representation of a particular demographic group (Gustafson et al. 2013). There are distinct dispensary types with various marketing techniques that appeal to different populations (e.g. medical care dispensaries versus recreational dispensaries) that may target specific populations of marijuana users (Graves 2011). Different types of dispensaries also offer different types of products as they cater to specific populations (Graves 2011). Dispensaries that attract younger, more recreational users may be more willing to participate in data collection practices, while smaller

dispensaries that cater to older populations or persons who use marijuana strictly for medicinal purposes may be less willing to participate. Product offerings may provide insight into the type of dispensary in operation (Graves 2011). Attempting to visit different types of dispensaries and visiting a variety of locations at different times and on different days may help to minimize selection bias in venue based sampling (Pollack et al. 2005; Reiman 2005).

Nonresponse bias may also occur when conducting venue based sampling and collecting information about socially stigmatized behavior (Jenness et al. 2011). Individuals who choose to respond to the survey may do so because they have a strong interest in medical marijuana policy resulting in survey responses that may not be representative of the greater population. Younger patients may also be more willing to participate in survey data collection. Although this bias occurs to varying degrees with all sampling methods, efforts to engage all individuals present at the venues for inclusion in the study help to minimize nonresponse bias on survey results (Olson 2006).

Stigma may influence both the types of dispensaries that choose to participate in data collection and the variety of respondents that choose to complete surveys (Weir et al. 2012). Smaller dispensaries with less patient traffic who attempt to obscure their presence from neighborhoods may be less willing to participate in surveys. Larger sites with greater traffic of patients that cater to recreational users may be more willing to participate. Additionally, younger patients who frequent dispensaries with larger dispensaries with greater product offerings may be willing to answer surveys on marijuana use. Methods to monitor selection and respondent bias are necessary when attempting to survey hidden populations (Jenness et al. 2011 Weir et al. 2012). The busyness of the dispensary site, the size of the dispensary, types of products offered, characteristics of patients that tend to frequent the dispensaries and the types of neighborhood they inhabit can provide insight into the types of dispensaries participating in data collection.

Key issues when assessing rigor in sampling include eligibility rates, participation rates, and completion and/or drop-out rates (Raymond et al. 2010). Using two-stage, venue-based sampling methods at medical marijuana dispensaries, we examine whether or not procedures we use introduce selection or non-respondent bias. We explore the following questions:

1. Are dispensaries that agree to let patients be surveyed different from those dispensaries that do not?
2. Are individuals who respond to the survey different from those who did not respond?

## METHODS

### Study Design and Sampling Procedures

The UCLA Medical Marijuana Study used a two-stage, venue-based sampling approach. First, the premise survey, a census survey of open dispensary locations in Los Angeles, generated detailed information about dispensary operations. Dispensaries were then randomly sampled to participate in patient survey data collection. The second stage involved

recruiting patients for participation in the exit and patient surveys in order to solicit additional information about patient health and marijuana use.

For this study, one survey was conducted to gain information on the dispensary (premise survey) and two surveys were conducted with the patients (exit and patient surveys). In order to cultivate a list of dispensary locations for the study, information was gathered from three sources: (1) a list of registered dispensaries with the Department of Finance in the City of Los Angeles; (2) registries of dispensaries from websites (e.g., weedmaps, stickyguide), and (3) trade publications with advertisements for dispensaries (e.g., LA Weekly, High Times Magazine). The list was then de-duplicated resulting in 875 unique locations. New dispensaries were added if research assistants noticed locations in the field that were not on the list.

**The premise survey**—Research assistants visited each unique location during July of 2012, collecting data on several key indicators. First, the research assistant determined if the location is operating as a dispensary. If the location appeared to be operating as a dispensary, he or she proceeded to enter the site. If the location did not appear to be operating as a dispensary, additional information to confirm if and when the dispensary ceased to operate was collected by approaching current owners/managers and neighboring businesses. Physical indicators such as “for sale” or “for lease” signs, out of business notifications, or change of address notifications were also recorded.

Prior to entering the dispensary site, research assistants collected observational data including neighborhood type and storefront characteristics. Upon entering the dispensary, additional observational data on interior maintenance, interior lighting, patron descriptions, noise level, size of the establishment, the presence of state medicinal guidelines, and interior security in the entry room was collected. Research assistants then followed the procedures to enter the dispensing room and requested to speak with a manager or owner in order to collect further data on product offerings, dispensary rules and guidelines such as hours of operation and purchase limits, as well as additional patron descriptions. If a manager or owner was not present, the research assistant questioned the employees who were present. The final sample of 476 operating dispensary locations served as the sampling frame for recruiting dispensaries for the next phase of the study.

**The exit survey**—The exit survey was conducted during April – June of 2013. Project staff requested participation from dispensary managers and owners according to the randomized list until 16 dispensary sites agreed to participate in the exit survey. Thirty-seven dispensaries declined participation, 3 sites initially accepted participation and then later declined, and 11 sites on the randomized list had since closed. At each of the 16 dispensaries, research assistants conducted a brief (3–5 minute) in-person survey. Dispensary patrons were eligible for participation if they were 18 years of age or older and possessed a medical marijuana recommendation. Research assistants were either stationed outside of the dispensary entrance or inside the dispensary entry room. Upon exiting the dispensary, patrons were approached to participate in the brief survey. Participants gave informed consent and were offered \$20 in cash as an incentive for participation. If a dispensary patron declined participation, observational data on the patron’s race, age, and

gender were collected. Exit surveys were completed on either an iPod touch or on paper. A total of 600 exit surveys were collected; 110 patrons declined participation resulting in a response rate of 84.4%.

**The patient survey**—Patrons who participated in the exit survey at the 16 dispensary locations were offered an additional incentive to participate in the longer 30-minute patient survey; and each participant was provided an additional statement of consent. The patient survey could be completed on-site via tablet or paper for a \$30 gift card to Target or on-line at home for a \$30 gift card to Amazon.com and operated as an extension of the exit survey. Participants who chose to complete the survey on-line at home were provided with a business card that included the survey website and a unique login ID and password. Of the 600 exit survey respondents, 423 participated in the patient survey resulting in a conversion rate of 70.5%. To ensure accurate recording of all data, two research assistants double entered paper versions of the exit and patient survey into the final database, resulting in two entries for each case. Data was then checked and de-duplicated to reduce data entry error.

## Measures

**The premise survey**—The dependent variable is participation in the exit survey data collection. The independent variables for the premise survey include the following variables: *neighborhood type* denotes if the dispensary is located in a residential (private houses/ residential apartments), retail (stores and commercial shops), mixed-use (combination of residential and retail outlets), industrial (warehouses and industrial sites) or office park area (a collection of offices built together on landscaped grounds). Due to low sample sizes, residential and mixed-use sites were grouped together and industrial and office park sites were grouped together. *Building type* is a categorical variable identifying if the dispensary building is a house, office building, warehouse, storefront on street, or shopping center. For the purpose of analysis, house, office building and warehouse were grouped together as non-commercial. *Outside appearance* is a categorical variable highlighting if the dispensary is most similar to a generic store (average storefront property), a medical facility (facility indicating medical services are provided by either motifs or signs), an office (facility most closely resembles an office building), or a residence (residential house or apartment). Final categories included generic store and other. *Safety* classified how safe research assistants felt in the neighborhood using a 4-point Likert scale ranging from very unsafe (necessary to leave the establishment for fear of harm as a result of neighborhood environment, dispensary patrons and/or complete lack of security measures) to very safe (environment is very safe as a result of neighborhood environment and security measures). Very unsafe, somewhat unsafe and somewhat safe were grouped together. *Interior condition* denotes if the maintenance is excellent (very clean, recent paint or remodel, etc.), good (no peeling paint or scattered litter, etc.), fair (minor disrepair, some litter, etc.), or poor (graffiti, broken windows, lots of litter, etc.). Fair and poor were combined for analysis. *Busyness of the establishment* is a 4-point Likert scale ranging from very busy to not at all busy during the time of visit. Very busy, busy and somewhat busy were combined. *Demographic information of patrons* include gender, the approximate age range of the oldest, youngest and average patrons, and the racial percentage of patrons present at the dispensary. Dispensaries were coded as containing either greater than or less than 50% of white, black and Latino patrons.

**The exit survey**—The dependent variable for the exit survey is individual participation in the survey given that patrons had the option to participate. Independent variables for the exit survey document the following: *Demographic information* including age, gender, race and ethnicity (Hispanic or non-Hispanic). Asian/Asian-American and Native Hawaiian or other Pacific Islander was combined into one race and American Indian or Alaska Native was combined with the ‘Other’ racial category. Respondents sometimes selected more than one racial category, however, research assistants selected only one racial category for each non-respondent who chose not to participate. Individuals were coded as either 1 or 0 for each racial category; analysis entailed separate tests for each group rather than a group analysis of race to address the discrepancy between respondent and non-respondent racial identification. *Marijuana purchase* is a dichotomous variable noting whether or not the respondent purchased medicinal marijuana during current visit. *Type of purchase* identifies the cannabis type including marijuana bud, strain type, quantity, clones/seeds, pre-rolled joint, concentrates, and/or edibles and edible type. Respondents were also asked the *amount spent on purchase*. *Recommendation type* identifies the condition for which patron was given medical marijuana recommendation. Categories for recommendation type include anorexia, anxiety, appetite stimulant, arthritis, cancer-related symptoms, chronic pain, Chron’s Disease, depression, epilepsy, glaucoma, HIV/AIDS, migraine, sleep problems, spasticity, and ‘other.’ Due to low number of responses, anorexia, cancer-related symptoms, Chron’s disease, glaucoma, HIV/AIDs, and spasticity were grouped together to encompass serious illnesses.

**The patient survey**—The dependent variable for the patient survey is participation in the survey given that respondents had the option to respond to the subsequent survey. This provides an assessment of whether there was bias in the portion of the sample that responded to the longer survey. The independent variables for the patient survey included the demographic information collected from the exit survey including age, gender and race. Race was coded identical to the exit survey.

### Data Analysis Procedures

This study employed chi-square analysis to assess potential sample bias among survey respondents. Cramer’s phi, Cramer’s V and Cohen’s d coefficients were used to measure effect sizes. First, analyses were conducted to assess potential bias within dispensaries that agreed to participate in the exit and patient surveys. Second, analyses were conducted to examine differences among patrons who responded to the exit survey and those that did not. Additional analyses examined sample bias among patient survey respondents in order to investigate statistical difference between patient survey respondents and those non-respondents who chose not to complete the patient survey. Finally, a chi square test of independence was used to assess differences among patient survey respondents who used the web version of the survey and respondents who used the paper version of the survey.

## RESULTS

Table 1 shows the results of participating and non-participating dispensaries in the exit and patient surveys. For the purpose of analysis, the 3 dispensaries that initially accepted

participation and then later declined were grouped with the 37 dispensaries that declined resulting in 40 dispensaries that declined participation and 16 participating dispensaries. The 11 closed dispensaries were omitted from the analysis. The relation between certain product offerings and participation was statistically significant. Confirming our hypothesis, participating dispensaries tended to carry more novel products such as honey oil,  $\chi^2(1, N = 48) = 3.23, p = 0.072, \Phi_{\text{Cramer}} = 0.260$ ; and hash,  $\chi^2(1, N = 48) = 5.65, p = 0.017, \Phi_{\text{Cramer}} = 0.343$ .

Dispensaries did not differ by neighborhood type, building type. Furthermore, there was no statistical variation among the presence of a doorman, security cameras, or the posting of operating hours. The interior size of the dispensaries did not differ. The relation among the busy indicator was not significant.

Table 2 displays the results of sample bias among respondents who chose to participate in the exit survey and those who declined participation based on the three observational variables collected on non-respondent patrons (e.g. age, race, and gender). African-American respondents were more likely to respond to the exit survey as compared to respondents who did not identify as African-American. Hispanic, Other and White patients were also more likely to respond to the exit survey,  $\chi^2(1, N = 701) = 15.05, p = 0.000, \Phi_{\text{Cramer}} = -0.147, \chi^2(1, N = 690) = 5.29, p = 0.021, \Phi_{\text{Cramer}} = -0.088, \chi^2(1, N = 701) = 15.09, p = 0.000, \Phi_{\text{Cramer}} = -0.147$ , and  $\chi^2(1, N = 701) = 22.01, p = 0.000, \Phi_{\text{Cramer}} = 0.177$ , respectively. There was no statistical difference among Asians. Patrons did not differ by age nor gender.

Table 2 also displays the results of sample bias among exit survey respondents who chose to complete the longer patient survey. Respondents did not differ from non-respondents by age or gender. Finally, for respondents who used the web version versus the paper version of the survey, the only significant difference was forage, with older respondents being more likely to complete the paper version and younger respondents opting for the web version (Table 2).

## DISCUSSION

Overall, selection bias was generally absent among study results. These results suggest that the use of venues or dispensaries to access and survey medical marijuana users is acceptable (Olson, 2006; Reiman, 2005; Walsh et al., 2013). Dispensaries provide access to medical marijuana patients that allow researchers to gather information regarding patient health and use practices that are integral to a better understanding of the population of medical marijuana users.

Results illuminated the minimal respondent bias observed among the exit and patient survey respondents. We did find racial/ethnic differences in those who completed the exit survey vs. those who did not. African-American, White, and Hispanic respondents were all more likely to respond to the survey as compared to individuals who did not identify with each respective ethnic group.

Results show minimal selection bias among dispensaries that chose to participate in the survey. The only significant difference among dispensaries that chose to participate in the

exit/patient surveys and those that did not was that those who participated sold more products (honey oil and hash). Effect sizes indicate a moderate association among these characteristics. Thus, some bigger dispensaries that sell more products may be more willing to engage in data collection for research purposes, as they may already be more visible or engage in more visible marketing practices.

For the patient survey, web survey respondents tended to be younger than paper survey respondents, a finding that appears in other studies (Kaplowitz, Hadlock & Levine 2004). Together, these findings suggest minimal selection and respondent bias among both dispensaries and survey respondents.

Limitations include partial reliance on observational data. For example, information collected about non-respondents for the exit survey (age, race, and gender) was derived from observational documentation of non-respondent characteristics by research assistants. Hence, accurate information detailing non-respondent characteristics is subject to observer bias. Additionally, this study collected patient information from 16 dispensaries in Los Angeles, therefore, generalizability of results outside of Los Angeles is limited.

Efforts to monitor selection and non-respondent bias are important in all sampling methods, including venue-based sampling (Jenness et al. 2012; Weir et al. 2012). Documentation of venue characteristics, non-respondent characteristics, and respondent characteristics in order to examine differences in participation rates and completion rates serve to strengthen study results and attend to any bias that may surface (Raymond et al. 2010). Results from this study suggest that the use of venues to sample medical marijuana users is a viable option to gather information on patient health and use that adequately represents the greater population of medical marijuana users in Los Angeles. Thus, recommendations and conclusions based on findings from venue-based studies of medical marijuana users at dispensary sites serve to inform meaningful research.

## Acknowledgments

Research for and preparation of this manuscript were supported by NIDA Grant R01-DA-032715. The content is solely the responsibility of the authors and does not necessarily represent their views.

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**Table 1**  
Comparing Participating Dispensaries to Non-Participating Dispensaries (N = 67)

	Full Sample		Participating	Non-Participating	<i>p</i>	$\Phi$
	%	<i>n</i>	%	%		
<i>Dispensary Characteristics</i>						
Neighborhood Type					0.320	0.203
Residential/Mixed Use	32.7	18	25.0	35.9		
Retail	61.8	34	75.0	56.4		
Office Park/Industrial	5.5	3	0.0	7.7		
Dooman					0.507	0.089
Yes	3.6	2	6.2	2.6		
No	96.4	53	93.8	97.4		
Security Camera					0.868	-0.022
Yes	94.5	52	93.7	94.9		
No	5.5	3	6.3	5.1		
Operating Hours Posted					0.115	-0.213
Yes	34.5	19	18.8	41.0		
No	65.5	36	81.2	59.0		
Interior Size					0.599	0.145
Small	36.7	18	40.0	35.3		
Medium	49.0	24	53.3	47.1		
Large	14.3	7	6.7	17.6		
Busy					0.272	0.159
Not Busy	64.6	31	53.3	69.7		
Busy	35.4	17	46.7	30.3		
<i>Product Offerings</i>						
Honey Oil					0.072	0.260
Yes	29.2	14	46.7	21.2		
No	70.8	34	53.3	78.8		
Hash					0.017	0.343
Yes	47.9	23	73.3	36.4		

$\Phi$	$d$	Non-Participating	Participating	Full Sample
		%	%	$n$
		63.6	26.7	25
				%
				52.1
				No

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**Table 2**

Comparing Exit Survey Respondents to Non-Respondents (N = 705)

	Full Sample		Respondents		Non-Respondents		p	Φ (d)
	%	N	%	M (SD)	%			
Age		1,32					0.907 (0.013)	
Gender							0.374	0.034
Male	77.7	546	83.7		16.3			
Female	22.3	157	86.6		13.4			
Race								
Asian or Asian-American							0.115	0.060
Yes	5.8	41	5.2		0.09			
No	94.2	660	94.8		90.9			
African-American							0.000	-0.147
Yes	32.1	226	34.9		16.4			
No	67.3	475	80.6		19.4			
White or Caucasian							0.000	0.177
Yes	47.7	366	48.1		72.7			
No	47.5	335	51.6		27.3			
Other							0.000	-0.147
Yes	5.8	41	5.2		9.1			
No	94.2	660	94.8		90.9			
Hispanic							0.021	-0.088
Yes	25.1	173	26.6		15.6			
No	74.9	517	73.4		84.4			
Comparing Conversions to Non-Conversions (N = 598)								
Age	33.96 (12.83)	593	34.13 (12.58)				0.604 (-0.462)	
Gender							0.062	-0.077
Male	77.1	457	75.0		82.1			
Female	22.9	136	25.0		17.9			

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	Full Sample		Respondents		Non-Respondents		<i>d</i>	$\Phi$ (d)
	%	<i>N</i>	%	<i>M</i> ( <i>SD</i> )	%			
Comparing Web Survey to Paper Survey (N = 420)								
Age		33.96		35.12 (12.92)		31.13 (11.14)	0.003	(-0.331)
Gender								
Male	74.8	312	74.1		76.9			76.9
Female	25.2	105	25.9		23.1			23.1
							0.568	-0.028