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COMPARING THE EFFECTIVENESS OF TWO FORMS OF TIME-SPACE SAMPLING TO IDENTIFY CLUB DRUG-USING YOUNG ADULTS

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Abstract

Time-space sampling has been used to generate representative samples of both hard-to-reach and location-based populations. Because of its emphasis on multi-tiered randomization (i.e., time, space, and individual), some have questioned the feasibility of time-space sampling as a cost-effective strategy. In an effort to better understand issues related to drug use among club-going young adults (ages 18 to 29) in the New York City nightlife scene, two variations of time-space sampling methods were utilized and compared (Version 1: randomized venue, day, and individuals within venues; Version 2: randomized venue and day). A list of nightlife venues were randomized and survey teams approached potential participants as they entered or exited venues to conduct brief anonymous surveys. Over the course of 24 months, 18,169 approaches were conducted and 10,678 consented to complete the brief questionnaire (V1 response rate = 46.0%, V2 response rate = 62.5%). Drug use was fairly common, with nearly two-thirds of the sample reporting having ever tried an illegal drug and more than half of drug users specifically tried either MDMA/ecstasy and/or cocaine. There were few differences between young adults surveyed during Version 1 and Version 2. Time-space sampling is an effective strategy to quickly detect and screen club drug users. Although caution is urged, elimination of the third tier of randomization (i.e., individual level counting) from time-space sampling may significantly improve response rates while only minimally impacting sample characteristics.

INTRODUCTION

Time-space sampling is a methodology increasingly used in urban health research. It has been used to generate representative samples of location-based populations such as travelers to particular destinations, (e.g., museums and polling places, Kalton, 1991); hard-to-reach populations, including lesbians, gay, and bisexuals (Corliss, Cochran, & Mays, in press); and specifically populations at risk for HIV/AIDS (Kalton, 1993; Semaan, Lauby, & Liebman, 2002), such as men who have sex with men (Agronick et al., 2004; Choi et al., 2004; Diaz, Ayala, & Bein, 2004; Fernandez et al., 2005; Fernandez et al. 2007; MacKellar, D.A., Valleroy, L., Karon, J., Lemp, G., & Janssen, R., 2006; MacKellar, D.A., Valleroy, L., Karon, J., Lemp, G., & Janssen, R., 2007; Mansergh et al., 2006; Muhib et al., 2001; Stueve, O'Donnell, Duran, San Doval, & Blome, 2001; Valleroy et al., 2000). This sampling methodology was most comprehensively implemented by the Centers for Disease Control's National HIV Behavioral Surveillance system of men who have sex with men, conducted in 17 metropolitan areas in the United States and Puerto Rico (MacKellar et al., 2007)

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Our research team employed time-space sampling to generate a sample of “club drug” users among club-going young adults. “Club drugs” encompass a diverse range of substances that emerged during the 1990s as major drugs of use and abuse in the United States and elsewhere. Club drugs include MDMA (methylenedioxymethamphetamine), or “ecstasy,” methamphetamine (crystal meth), cocaine, ketamine, LSD (d-lysergic acid diethylamide), and GHB (γ -hydroxybutyrate) and its derivatives (Leshner, 2000; Maxwell, 2005; Nanin & Parsons, 2006). Researchers have attempted to assess the prevalence of club drug use by incorporating a variety of sampling methodologies. These have included large-scale national surveys such as the National Survey on Drug Use and Health [NSDUH] (Office of Applied Studies, 2005) and The Monitoring the Future Study (MTF) (Johnston, O’Malley, Bachman, & Schulenberg, 2006). Although neither of these national studies assessed a complete range of club drugs, these data indicate high rates of exposure during one’s lifetime to MDMA/ecstasy (12.4% to 14.9%), cocaine (12.6% to 14.3%), and LSD/acid (7.9% to 11.2%) among young adults (18 to 25 year olds in the NHSDA and 19 to 28 year olds in the MTF). These general population estimates are essential to illustrate the dispersion of drug trends, but it is equally important to identify and assess prevalence among key groups and target populations (Kelly, Parsons, & Wells, 2006; Lankenau & Clatts, 2002; McCaughan, Carlson, Falck, & Seigal, 2005; Ompad, Galea, Fuller, Edwards, & Vlahov, 2005).

Although researchers have examined substance use within club cultures (Barrett, Gross, Garand, & Pihk, 2005; Klitzman, Pope, & Hudson, 2000; Ter Bogt & Engels, 2005; Yacoubian et al., 2004), these data were drawn largely from convenience samples. Thus, a comprehensive sampling of these cultures is essential to fully grasp variation and prevalence of club drug use among club-going young adults. Because time-space sampling allows for strategic sampling of underrepresented groups, such as sexual minorities, this methodology allows for the systematic evaluation of club drug use across gender and sexual orientation, resulting in samples with large enough subpopulations for analysis of potential differences.

Time-space sampling is named for the randomization of time (whether it be day of week, and/or segment times during a particular day), space (venue/location to which participants are to be drawn from), and often individuals (every n^{th} person entering a venue). Several steps are involved in the employment of time-space sampling. Researchers establish a sampling frame, which includes all possible venues, days, and times (VDT units) from which the sample will be drawn. By so doing, time and place are the primary sampling units, and respondents are recruited through random sampling in places and at times where they are expected to gather (Semaan et al., 2002). This determination is based on “social viability” (Kelly et al., 2006), which assures that an adequate number of the target population will be found at the venue, and suggests the times that this population can be engaged. In the case of club-going young adults, nightclubs that are attended by young adults, followed by the time frame—either day of week or time of day—must be identified. Once an exhaustive list of VDT units is identified, they are randomly sampled over the course of the recruitment period. Ideally, VDTs should be sampled so that the probability of being chosen is proportional to the size of the eligible population for each VDT unit.

In an effort to ensure an exhaustive list of VDTs are generated, researchers can examine local publications, conduct ethnographic fieldwork, identify and interview key informants/gatekeepers, conduct individual interviews or focus groups with the target population, and learn where potential respondents gather. After an exhaustive list of venues has been identified, the research team can then number and randomize the venue, the times to attend the venue, and the visitors within the venues (i.e., every n^{th} person crossing a particular threshold) (Corliss et al., in press, Fernandez et al., 2005; Fernandez et al., 2007). As noted by Corliss et al.(in press):

The main advantage of time-space probability sampling is its efficiency in drawing a systematic sample. In addition, it can allow for targeted sampling of underrepresented racial and ethnic minorities and sexual minorities. If implemented well, studies using time-space probability samples have the potential to yield quality information about small, underrepresented populations that are known to congregate in specific places.

Convenience samples (Centers for Disease Control and Prevention, 1998, 2004), targeted sampling approaches (Robinson et al., 2006; Watters & Biernacki, 1989), and respondent-driven sampling (Heckathorn, 1997, 2002) have also been utilized to recruit hard-to-reach populations (such as drug users). However, in an effort to improve the generalizability of samples, others have argued that probability-based approaches should be incorporated into sampling schemas (Schwarcz, Spindler, Scheer, Valleroy, & Lansky, 2007). One such melding has been that of time-space sampling. Nevertheless, time-space sampling has been noted for the increased costs associated with this strategy (e.g., staffing and time) (Fernandez et al., 2007; Magnani, Sabin, Saidel, & Heckathorn, 2005).

When comparing time-space sampling to traditional probability sampling, such as random-digit dialing, researchers have suggested that decreasing the types of venues and time spent in the field could significantly reduce costs (Pollack, Osmond, Paul, & Catania, 2005). In an effort to meet their sampling goals and frameworks, researchers have adapted several variations of time-space sampling (Agronick et al., 2004; Fernandez et al., 2005; Fernandez et al., 2007). For example, Mackellar and colleagues (2007, 2006) “counted” all participants who crossed an imaginary line/threshold (such as the entrance to a night club), Muhib and colleagues (2001) “systematically” approached those who crossed such a pre-defined threshold, and Fernandez and colleagues (2005, 2007) specified having approached every n^{th} person. Thus, the deployment of time-space sampling has varied and these adaptations have begged the question of whether it is essential to randomize time, venue/location, *and* (randomize/count) persons within locations, or whether it is sufficient to randomize only by time and location. The belief that a tri-level randomization is essential relies on the assumption that not randomizing individuals will somehow bias the sample (e.g., interviewers will only approach people who they “want” to approach, or feel comfortable approaching, versus “having” to approach on a random basis) (Oakes & Kaufman, 2006; Schwarcz et al., 2007). Eliminating the third tier of randomization (i.e., person-level) could potentially save recruitment expenses by increasing the number of approaches (e.g., not “waiting” for the n^{th} person) and more effectively utilize survey staff’s time (e.g., elimination of the “counter”), therefore improving the feasibility of time-space sampling as a cost effective approach to identifying probability based samples over more convenience-based or less methodologically rigorous approaches (Pollack et al., 2005; Robinson et al., 2006; Schwarcz et al., 2007).

CURRENT FOCUS

Time-space sampling has been identified as an effective strategy to generate probability-based samples of location-based and hard-to-reach populations. In its development, researchers questioned time-space samplings cost-effectiveness and the various ways it has been deployed. This analysis describes the results of a New York City-based survey focused upon club drug use among club-going young adults. Specifically, this analysis seeks to evaluate the effectiveness and compare and contrast sample differences from utilizing two variations of time-space sampling. Although the specific findings related to the prevalence of drug use (and racial/ethnic, gender, and sexual orientation differences) among this population have been published elsewhere (see Kelly et al., 2006; Parsons, Kelly & Wells, 2006), this evaluation intends to determine the impact of variations in time-space sampling methodology on the sample variability. As existing studies on this population have largely

relied on convenience samples (Barrett et al., 2005; Klitzman et al., 2000; Ter Bogt & Engels, 2005; Yacoubian et al., 2004), this novel sampling methodology allows us to generalize our findings to the population of young adults who attend dance clubs in New York City (NYC). Thus, the random nature of time-space sampling methodology helps to address some of the issues around the generalizability of rates of club drug use among this population.

MATERIALS AND METHODS

The *Club Drugs and Health Project*, broadly conceived, was a study of health issues among young adults (ages 18 to 29) involved in NYC dance club scenes (Kelly & Parsons, 2007; Kelly et al., 2006; Parsons, Kelly, & Weiser, 2007; Parsons, Kelly et al., 2006). In particular, the project was designed to examine the patterns and contexts of club drug use and its associated risks among club-going young adults with the intent of assessing the potential for prevention and educational efforts. For this study, the specific club drugs of interest were MDMA/ecstasy, ketamine, GHB, methamphetamine, cocaine, and LSD/acid. Though, based upon prior work, there are other drugs classified under this framework (e.g., Rohypnol®) we are aware that these particular substances are not salient club drugs in NYC (Kelly, 2005; Parsons, Halkitis, & Bimbi, 2006). The survey utilized in the study was designed to assess the prevalence of club drug use among club-going young adults and obtain basic information on other health issues relevant to this population. The data drawn upon for this paper comes from the anonymous screening survey collected over a 24-month period (December, 2004 to December, 2006) in which two variations of time-space sampling methodology were employed (Version 1: randomized venue, day of week, and individuals within-venues; Version 2: randomized venue and day only). The brief survey lasted approximately two minutes and participants were given no compensation. Human subjects approval was obtained from the Institutional Review Board of the first author.

SAMPLING

To generate a proper sample of a venue-based population located at nightclubs in NYC, nightclubs served as the basic sampling unit. Rather than randomizing households or phone numbers as some other probability-based sampling methods do, we randomized both the days we recruited and the venues at which we recruited.

TIME-SPACE SAMPLING, VERSION 1 (DECEMBER, 2004 TO JULY, 2005)

During the first variation of time-space sampling, three tiers of randomization were utilized: (1) the venues attended, (2) the days attending the venues, and (3) the young adults attending the venues (i.e., selecting every n^{th} person who crossed a particular threshold). We first randomized “time and space” using a sampling frame of previously enumerated clubs and time periods of operation. Once at the venue, we randomized the individuals (i.e., every n^{th} individual) (Fernandez et al., 2005; Fernandez et al., 2007) crossing a pre-determined imaginary threshold at the venue (MacKeller et al., 2007; MacKeller et al., 2006; Muhib et al., 2001).

To construct the sampling frame, preliminary fieldwork was conducted to ascertain “socially viable” venues for each day of the week. Social viability was determined if a certain threshold of patron traffic existed at the venue on that given day of the week (e.g., a minimum of 10 “age eligible” individuals per recruitment hour per shift). For example, if a club is open on Thursdays but only three young adults usually show up, or it caters to an over-40 crowd, it was not considered a socially viable venue on Thursday evenings. We generated lists of socially viable venues for each day of the week, for a total of 223 venues over the course of the project. For each day of the week, every socially viable venue was

listed and assigned a number. Then, using a random digit generator program, a random number was drawn for each recruitment day of that month. Each random number drawn corresponded to a given venue. This process ultimately yielded our schedule of venues for each month.

Given that Friday and Saturday nights are the most common “party” nights, we weighted these recruitment days by sampling additional venues and adding additional recruitment shifts on these days. All Fridays and Saturdays were considered “weekend days.” Also, during the year certain other days were assigned “weekend” status depending on the specifics of those dates. The primary defining characteristic of a “weekend” night was that most individuals would not have to attend work/school the following day. For example, a Sunday night on a holiday weekend would have been assigned “weekend” status, even though most Sunday nights were not considered “weekend” nights.

During the first version of recruitment, three members of each recruitment team were assigned separate responsibilities: one served as a “counter” and two as “screeners.” To achieve person-level randomization at each venue, the counter—typically the shift supervisor—tracked and counted every individual crossing a pre-determined threshold outside of the venue (e.g., the entrance; MacKeller et al., 2007, MacKeller et al., 2006; Muhib et al., 2001). Every n^{th} person to cross that threshold was selected for the survey. Thus, once a certain number in the count had been reached, the counter assigned a screener to the individual selected at random. The n was adjusted to match the level of patron traffic such that high-traffic nights (typically Friday and Saturdays) called for a higher n (e.g., every 7th person) and lower-traffic nights/venues called for a smaller n (e.g., every 5th person). The consideration of traffic flow allowed for individuals attending smaller venues and on “off nights” to be adequately represented in the sample. In the event that traffic flow dramatically changed during the course of the night, the counter was permitted to alter the n once during the night, by plus or minus two persons, in order to accommodate the variance in population.

For the duration of each recruitment shift, the counter continued to count patrons and assign the screeners at the designated random intervals to the young adults attending the venue. The screeners approached the assigned individual immediately, identified themselves, and requested verbal consent for participation in the anonymous brief survey. After obtaining verbal consent, the survey staff orally administered the survey and keyed the participant’s responses onto a Palm Pilot PDA. If the patron refused, the screener noted their refusal and estimated their age, gender, and ethnicity. Although the estimated information for refusals was not included in this analysis, it was collected for the supervision and global tracking of refusal rates and demographic characteristics of those declining to participate. Field staff members were instructed not to administer surveys to any individuals who were visibly impaired by intoxicants. This version of time-space sampling was used from December 2004 to July 2005.

TIME-SPACE SAMPLING, VERSION 2 (JULY, 2005 – DECEMBER, 2006)

The identical study protocol for the first version of time-space sampling was followed with the exception of *not* including person-level randomization. In this instance, screening teams were comprised of *two* staff members (i.e., no counter), and these trained screening staff approached any patrons who crossed the pre-determined imaginary threshold of the venue (MacKeller et al., 2007, MacKeller et al., 2006; Muhib et al., 2001). Recruitment staff were instructed to survey the next possible person after they had completed their previous survey. In this regard, they were to attempt to survey all individuals crossing the threshold, thus maximizing screening efforts at all venues. While it was most often not possible to survey all individuals entering the club, we attempted to capture as large a segment of the patron

population for that evening as possible. This variation of time-space sampling was used from July, 2005 until December, 2006.

In order to ensure study protocol adherence, all recruitment staff received extensive and ongoing training and supervision throughout the course of the project. Both variations of time-space sampling were utilized to screen for eligibility for a larger research study, the *Club Drugs and Health Project*. Participants having met eligibility for the larger project were asked if they would be interested in participating in an additional study, handed an information card for the project, and asked to provide contact information. Participants were informed of the larger study only if they met that study's criteria. The *Club Drugs and Health Project* sought to enroll 400 young adults (100 gay/bisexual men, 100 lesbian/bisexual women, 100 heterosexual men, and 100 heterosexual women) in a longitudinal mixed-methods study.

MEASURES

Participants were asked to indicate their gender (male or female), age (in years), and to self-identify their sexual orientation, which was then categorized as either heterosexual or gay/lesbian/bisexual. Participants were also asked to self-identify their race/ethnicity, which was then categorized as White, Black, Latino, Asian/Pacific Islander, Mixed, and Other. To assess lifetime consumption of drugs, participants were asked whether they had ever used any illegal drugs. Those having used a drug were asked to indicate if they had ever used each of the following club drugs: MDMA/ecstasy, ketamine, GHB, cocaine, methamphetamine, and LSD/acid. In an effort to ensure vernacular drug name recognition, the research team also interchangeably used colloquial terms for drug's names while screening participants (e.g., Tina, crystal, and/or meth for methamphetamine).

Those participants reporting use of any of the six club drugs were asked to estimate how many days they used in the last year (categorized in this analysis as not used, once or twice, or three or more times). To assess recent use of club drugs, all participants having used three or more times were asked if they had used "any of these six club drugs" within the past three months. Recent use was dichotomized "Yes" or "No." As the *Club Drugs and Health Project* was specifically interested in young adults, and our recruitment efforts targeted young adults; only the data from 18–29 year olds have been included in these analyses ($N = 10,678$).

ANALYTIC PLAN

All data were transposed into an SPSS database. Where appropriate, χ^2 and statistical t -tests were utilized to assess for significant differences between the two versions of time-space sampling. Specific analyses comparing/contrasting gender and sexual orientation differences in drug use have been reported elsewhere (Kelly et al., 2006; Parsons, Kelly et al., 2006). When surveying for Version 1, roughly equal portions of gay/bisexual men, lesbian/bisexual women, straight men and straight women were screened; however, approximately a year into screening for Version 2, gay/bisexual male venues were removed from the venue enumeration table and the recruitment team ceased recruiting at these venues after meeting enrollment targets for gay and bisexual men for the longitudinal study (although gay and bisexual men were screened if found at other venues). Due to this reduced proportion of gay/bisexual men screened during Version 2, and because drug use has been shown to vary according to gender and sexual orientation, analyses were split by gender and sexual orientation such that gay/bisexual men were analyzed independently from lesbian/bisexual women, heterosexual women, and heterosexual men (and vice-versa). In essence, data from gay/bisexual men screened during the first version were compared to data from gay/bisexual men screened during the second version. The same held for the other three groups. Finally,

to reduce the odds of type-I errors that can arise from the repetition of similar analyses, the significance level was changed from $p < .05$ to $p < .01$ (Tabachnick & Fidell, 2007).

RESULTS

RESPONSE RATE

Over the course of 24 months, 18,169 approaches were conducted ($n_{\text{Version 1}} = 4,135$; $n_{\text{Version 2}} = 14,034$), of which 10,678 (58.8%) consented to complete the brief questionnaire. In total, 1,614 gay/bisexual men, 1,781 lesbian/bisexual women, 3,439 heterosexual men, and 3,781 heterosexual women were surveyed. Data on the sexual orientation of 63 (.6%) participant were unavailable due to equipment failure and/or human error in PDA data entry. The response rate was significantly improved during the second version of time-space sampling: V1 response rate = 46.0% ($n = 1,904$ of 4,135) versus V2 response rate = 62.5% ($n = 8,774$ of 14,034), $\chi^2(1) = 357.7$ $p < .001$.

Recruitment staff estimated limited demographic characteristics of those participants refusing to participate in the brief survey (i.e., age, gender, and race). The estimated demographic characteristics of participants refusing to screen did not statistically differ from those consenting to screen.

SOCIO-DEMOGRAPHIC VARIABLES

There were no observed differences in the ages of female participants between Version 1 and Version 2. Compared with the men surveyed during Version 1, men were significantly younger during Version 2 by approximately 0.4 years (see Table 1). Further, within each of the four sexual orientation groups, there were no racial or ethnic differences from Version 1 to Version 2. In essence, *non-randomization* at the individual level had no measurable impact on the racial or ethnic distribution of the sample for the four target groups having participated in the survey.

DRUG USE

Compared to the heterosexual women surveyed during Version 2, heterosexual women surveyed during Version 1 were more likely to report having ever used a drug (67.7% v. 60.2%). There were no observed differences among heterosexual men, lesbian/bisexual women, or gay/bisexual men in the prevalence of having ever used a drug. For these three groups, the prevalence of having ever used a drug remained statistically similar from Version 1 to Version 2 (i.e., regardless of whether or not person-level randomization was used).

Among those who reported ever having used an illegal drug, there were no significant differences in the use of any of the six club drugs among gay/bisexual men surveyed during Versions 1 and 2, and none among lesbian/bisexual women surveyed during Versions 1 and 2. Compared with the heterosexual men surveyed during Version 1, heterosexual men surveyed during Version 2 were significantly less likely to report ever having used ketamine (33.2% v. 24.9%) and LSD/acid (43.7% v. 35.1%). Further, compared with the heterosexual women surveyed during Version 1, heterosexual women surveyed during version 2 were significantly less likely to report methamphetamine use (14.3% v. 8.7%). All other drug prevalence rates remained statistically similar from Version 1 to Version 2.

Those who reported having used a club drug were asked their frequency of use during the past year (categorized in this analysis as not used, used one to two times, or used three or more times), and those having used more than three times were asked if they had used in the last three months (i.e., recent use). Table 2 reports on the analyses of these subsamples. For

gay/bisexual men, lesbian/bisexual women, and heterosexual men, there were no significant differences in the distribution of the frequency of annual use from Version 1 to Version 2. In essence, whether randomization occurred at the individual level had no measurable impact on reported frequency of drug use in the last year. Compared to the heterosexual women surveyed during Version 1, heterosexual women from Version 2 were significantly more likely to report drug abstinence in the last year (52.4% v. 58.1%; see Table 2). Nevertheless, among those having used three or more times in the last year, individuals screened (within each of the four target groups) during Version 1 and Version 2 were equally likely to report recent drug use.

Focusing specifically on those individuals reporting frequent and recent club drug use (i.e., three or more times in the last year, with at least one of those times being in the last three months), the racial and ethnic distribution did not significantly differ from Version 1 to Version 2. Although there was some observed racial and ethnic variance among gay/bisexual men—comparable χ^2 analyses of the six different racial/ethnic groups could not be performed due to low expected counts among lesbian/bisexual women, heterosexual men, and heterosexual women—the proportion of Caucasians to persons of color did not significantly differ from Version 1 to Version 2 among gay/bisexual men, lesbian/bisexual women, heterosexual men, and heterosexual women. Again, randomization at the individual level had no discernible impact on the racial/ethnic distribution of the sample globally (see Table 1), nor on the proportion of Caucasians to persons of color found to report frequent and recent use (see Table 2).

DISCUSSION

Time-space sampling has been used to identify both location-based populations and hidden populations such as minority men who have sex with men (Corliss et al., in press). Although a generally agreed upon methodology for time-space sampling has been used by a variety of researchers with different populations, there has been some variability in the ways in which this method has been employed (Agronick et al., 2004; Fernandez et al., 2005; Fernandez et al., 2007). Meanwhile, some researchers have been ambiguous in the terminology they used to describe their deployment of time-space sampling (e.g., “counted” [without an indication as to randomization, or not], and “systematically approached” [without an operational definition provided for “systematic”]). Other researchers have questioned the viability of time-space sampling as a cost-effective method for engaging populations of interest, particularly hard-to-reach populations (Fernandez et al., 2007; Pollack et al., 2005; Robinson et al., 2006). One way to increase the cost-effectiveness of time-space sampling would be to eliminate the third tier of randomization (i.e., person-level counting) while maintaining the first (randomization of time/day) and second (randomization of space) tiers. Therefore, it is vital to assess if the removal of the third level of randomization has a measurable impact on the sample obtained. To better answer this question, two variations of time-space sampling were utilized in surveying a location-based population, club-going young adults.

The data from this analysis indicate that time-space sampling is an effective strategy to screen club-going young adults and to identify club drug users among them. These findings suggest it may be possible to develop early drug prevention and educational interventions that can be specifically tailored to populations of a variety of race/ethnicity, gender, and sexual orientations. In the current study, sexual orientation was captured in two dichotomous categories (heterosexual versus lesbian/gay/bisexual). Although this analysis was able to distinguish heterosexual men and women from lesbian/bisexual women and gay/bisexual men, it is unclear what portion of the sample was only bisexual. Thus, a sexual orientation analyses between gay and bisexual men, and lesbian and bisexual women was not possible.

Future research should consider operationalizing bisexuality as a separate category from lesbian and gay.

Our analyses suggested that, in addition to reducing staffing costs (by eliminating the need for a staff member devoted exclusively to “counting”), the elimination of person-level randomization significantly improved response rates. We believe this improvement is because many participants were asked to complete the survey while they were in transit with friends/partner(s) into a venue. During Version 1 —individual level randomization— the counter identified the n^{th} individual and instructed the screener to approach that person. Accompanying friends of the individual, neither selected for screening nor wanting to wait, often continued on into the venues, leaving their friend behind with the screener. These participants often indicated they did not want to be left behind by their friends, so declined to participate in the screening, or rushed through answering the questions in order to catch up with their peers. We believe this may explain the variability in response rates from Version 1 to Version 2.

During Version 2, a team of two (or more) screeners could approach a small group of individuals and ask each of them to participate in the survey, thereby significantly improving the response rate. Consequently, this might also explain some of the variation in reported substance use specifically observed among heterosexual men and women. Although participants were asked to “step away” from others while completing the brief questionnaire, it is feasible that they were in close enough proximity to friends and believed these friends may overhear responses to survey questions being read aloud by the screener. In this instance, the prevalence of substance use might have been underestimated during Version 2. Nevertheless, it is unclear why this would have only happened for heterosexual men and women, but not gay/bisexual men or lesbian/bisexual women. Anecdotally, researchers have identified higher incidence of drug use among gay, lesbian, and bisexual populations (Bux, 1996; Jordan, 2000; Parsons, Halkitis, & Bimbi, 2006), and this higher incidence could be indicative of more relaxed social norms around drug use specifically among these populations (McDowell, 2000; Nanin & Parsons, 2006), thus increasing “comfort” in disclosing use. Nevertheless, further evaluation is necessary to better explore this relationship, and researchers seeking to utilize time-space sampling should consider these implications when designing their survey methodology.

Additional variables could have similarly played a role in some of the differences observed from Version 1 to Version 2. Data collection during Version 1 spanned the better part of winter, spring, and summer, but not fall, whereas Version 2 spanned all seasons. Further, although the global approach to screening and venue randomization remained consistent, there was some turn over in both recruitment staff and accessibility of venues (some venues closed, while new ones opened). These additional factors too should be considered for their potential impact in data collection over extended periods of time.

In addition to providing an analysis of time-space sampling as a recruitment method, these findings highlight the prevalence of drug use among club-going young adults. More than two-thirds of respondents indicated having ever tried a drug, with high percentages of these individuals having used a variety of club drugs, but especially cocaine and/or MDMA/ecstasy. Compared to national data from the Monitoring the Future Study (Johnston et al., 2006) and the National Household Survey on Drug Abuse (Office of Applied Studies, 2005), our findings highlight the strong connection between participating in “club culture” and the prevalence of club drug use. Although between group differences have been described elsewhere (Kelly et al., 2006; Parsons, Kelly et al., 2006), these findings exemplify—in addition to club drugs’ strong connection to nightclubs—the importance of understanding how the cultural contexts of gender and sexual orientation impact drug use trends.

Furthermore, this analysis extends beyond those of previous researchers having utilized these data, as this analysis contextualized subsets of club drug use specifically among drug users (i.e., “among those having tried a drug ...”) rather than attempting to globally map club drug use patterns.

Consideration of the limitations of this research is necessary. First, although a variety of probability and non-probability sampling strategies have been discussed, this analysis was unable to compare/contrast the overarching framework of time-space sampling to other methods, such as respondent driven sampling. Researchers have highlighted the strengths and weaknesses of different sampling strategies, and those seeking to adopt a strategy for their own research should first evaluate these before committing to a recruitment methodology. Second, in recruiting at bars, clubs, and lounges, we may have sampled heavy substance users who may not be representative of urban young adults as a whole. However, in sampling young adults at social venues, this research has moved beyond convenience-based or snowball samples typically used in research examining drug use. Nevertheless, these findings cannot be extrapolated to other venue-based populations who may gather in different environments such as house parties or at home. Third, during the first version of time-space sampling, we were able to calibrate the n to more closely match both patron traffic and size of venues. This calibration, or oversampling the attendees of smaller venues (by decreasing the n), might have improved the representativeness of the sample. During Version 2, it was essential to ensure that level of patron traffic (i.e., venue size) was taken into consideration during the venue randomization process. As discussed, VDTs should be sampled so that the probability of being chosen is proportional to the size of the eligible population for each VDT unit. This is important to consider when deciding which version of time-space sampling to adopt.

Despite these limitations, these findings have implications for future efforts using this methodology. First, these data indicate that time-space sampling can be used as an effective strategy to identify and engage club-drug users. This methodology could also be used to rapidly detect other potentially harmful behaviors or at-risk populations, such as binge-drinking young adults. Because of the ease that target-populations can be identified via time-space sampling, those seeking to adopt this method might further consider developing/evaluating brief field-based interventions that are delivered immediately to those identified using this approach. Second, the cost-effectiveness of time-space sampling could be greatly improved by eliminating person-level randomization, while maintaining the randomization of time and space. Nevertheless, researchers should fully consider and periodically evaluate if using a two-tier-only randomization schema may in some way bias either participants and/or their data in ways that were not apparent in this study.

Biographies

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Table 1

Comparing substance use and demographic characteristics from two versions of time-space sampling

	Gay and Bisexual Men			Lesbian and Bisexual Women			Heterosexual Men			Heterosexual Women		
	Version 1 ^a <i>n</i> =562	Version 2 ^b <i>n</i> =1052	<i>t</i> (1612)	Version 1 ^a <i>n</i> =385	Version 2 ^b <i>n</i> =1396	<i>t</i> (1779)	Version 1 ^a <i>n</i> =449	Version 2 ^b <i>n</i> =2990	<i>t</i> (3437)	Version 1 ^a <i>n</i> =495	Version 2 ^b <i>n</i> =3286	<i>t</i> (3779)
Mean Age	24.2	23.8	-2.64**	24.3	24.1	-1.33	24.3	23.9	-3.32***	23.3	23.2	-0.43
Ever tried a drug	65.7%	69.6%	$\chi^2(1)$	75.8%	81.2%	$\chi^2(1)$	73.5%	71.6%	$\chi^2(1)$	67.7%	60.2%	$\chi^2(1)$
Among those having tried a drug												
...MDMA/Ecstasy	71.0	68.2	0.89	64.7	63.2	0.24	63.3	59.6	1.61	55.4	50.9	2.31
...Ketamine	37.3	34.5	0.80	25.4	24.8	0.06	33.2	24.9	10.23***	20.4	15.8	4.42*
...Cocaine	65.0	67.2	0.51	57.9	59.2	0.15	56.9	52.5	2.17	50.3	44.3	4.14*
...GHB	22.5	19.6	1.19	11.7	12.2	0.05	15.9	11.6	4.82*	10.5	7.7	2.90
...Methamphetamine	32.1	27.8	2.08	20.3	18.8	0.33	17.5	14.2	2.39	14.3	8.7	10.42**
...LSD/Acid	31.0	35.4	2.01	40.0	38.1	0.37	43.7	35.1	9.16**	30.2	23.8	6.25*
Race and Ethnicity			$\chi^2(5)$			$\chi^2(5)$			$\chi^2(5)$			$\chi^2(5)$
Asian	6.5	5.6	4.94	2.1	5.4	7.49	9.4	8.0	10.77	7.5	8.7	4.48
African American	9.5	9.2		9.6	7.9		4.0	5.8		4.2	5.6	
Latino(a)	18.4	14.8		14.4	14.0		10.0	12.4		12.8	12.2	
Mixed	6.5	7.0		7.2	7.1		4.6	4.2		5.7	3.8	
Other	3.0	4.9		4.8	6.4		9.1	5.4		3.3	4.0	
Caucasian	56.1	58.6		62.0	59.2		62.9	64.3		66.6	65.6	
Race and Ethnicity, dichotomous			$\chi^2(1)$			$\chi^2(1)$			$\chi^2(1)$			$\chi^2(1)$
Caucasian	56.1	58.6	0.63	62.0	59.2	0.74	62.9	64.3	0.24	66.6	65.6	0.12
non-Caucasian	43.9	41.4		38.0	40.8		37.1	35.7		33.4	34.4	

^aRandomized venue, time, and individual (Dec. 2004 – Aug. 2005), *N* = 1904

^bRandomized venue and time (Aug. 2005 – Dec. 2006), *N* = 8774

*
p ≤ .05

**
p ≤ .01

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100% $\geq d$

Table 2
Comparing substance use and demographic characteristics from two versions of time-space sampling among frequent drug users

	Gay and Bisexual Men			Lesbian and Bisexual Women			Heterosexual Men			Heterosexual Women		
	Version 1 ^a <i>n</i> =562	Version 2 ^b <i>n</i> =1052	<i>t</i> (1612)	Version 1 ^a <i>n</i> =385	Version 2 ^b <i>n</i> =1396	<i>t</i> (1779)	Version 1 ^a <i>n</i> =449	Version 2 ^b <i>n</i> =2990	<i>t</i> (3437)	Version 1 ^a <i>n</i> =495	Version 2 ^b <i>n</i> =3286	<i>t</i> (3779)
Mean Age	24.2	23.8	-2.64**	24.3	24.1	-1.33	24.3	23.9	-3.32***	23.3	23.2	-0.43
Ever tried a drug	65.7%	69.6%	$\chi^2(1)$	75.8%	81.2%	$\chi^2(1)$	73.5%	71.6%	$\chi^2(1)$	67.7%	60.2%	$\chi^2(1)$
Among those having tried a drug												
...MDMA/Ecstasy	71.0	68.2	0.89	64.7	63.2	0.24	63.3	59.6	1.61	55.4	50.9	2.31
...Ketamine	37.3	34.5	0.80	25.4	24.8	0.06	33.2	24.9	10.23***	20.4	15.8	4.42*
...Cocaine	65.0	67.2	0.51	57.9	59.2	0.15	56.9	52.5	2.17	50.3	44.3	4.14*
...GHB	22.5	19.6	1.19	11.7	12.2	0.05	15.9	11.6	4.82*	10.5	7.7	2.90
...Methamphetamine	32.1	27.8	2.08	20.3	18.8	0.33	17.5	14.2	2.39	14.3	8.7	10.42**
...LSD/Acid	31.0	35.4	2.01	40.0	38.1	0.37	43.7	35.1	9.16**	30.2	23.8	6.25*
Race and Ethnicity			$\chi^2(5)$			$\chi^2(5)$			$\chi^2(5)$			$\chi^2(5)$
Asian	6.5	5.6	4.94	2.1	5.4	7.49	9.4	8.0	10.77	7.5	8.7	4.48
African American	9.5	9.2		9.6	7.9		4.0	5.8		4.2	5.6	
Latino(a)	18.4	14.8		14.4	14.0		10.0	12.4		12.8	12.2	
Mixed	6.5	7.0		7.2	7.1		4.6	4.2		5.7	3.8	
Other	3.0	4.9		4.8	6.4		9.1	5.4		3.3	4.0	
Caucasian	56.1	58.6		620	59.2		62.9	64.3		66.6	65.6	
Race and Ethnicity, dichotomous			$\chi^2(1)$			$\chi^2(1)$			$\chi^2(1)$			$\chi^2(1)$
Caucasian	56.1	58.6	0.63	62.0	59.2	0.74	62.9	64.3	0.24	66.6	65.6	0.12
non-Caucasian	43.9	41.4		38.0	40.8		37.1	35.7		33.4	34.4	

^aRandomized venue, time, and individual (Dec. 2004 – Aug. 2005), *N* = 1904

^bRandomized venue and time (Aug. 2005 – Dec. 2006), *N* = 8774

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p ≤ .05

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p ≤ .01

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100% $\geq d$