THE SIDEWALK SURVEY

A Field Methodology to Measure Late-Night College Drinking

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Alcohol use is highly prevalent among U.S. college students, and alcohol-related problems are often considered the most serious public health threat on American college campuses. Although empirical examinations of college drinking have relied primarily on self-report measures, several investigators have implemented field studies to obtain objective measures of alcohol consumption (blood alcohol concentration) from students in ecologically valid settings. This article describes the methodology of breath-test field survey that is being conducted on the grounds of San Diego State University. Descriptive summaries of the data collected through spring 2003 are provided, and limitations to methodology are discussed.

Keywords *college drinking; objective measures; blood alcohol concentration (BAC); alcohol; field survey*

BACKGROUND

Alcohol use is highly prevalent among U.S. college students (Presley, Meilman, and Lyerla 1995), and alcohol-related problems are often considered the most serious public health threat on American college campuses (e.g., Wechsler et al. 1994). Several studies indicate that the prevalence of

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heavy episodic drinking among college students in the United States is moderately high (Wechsler et al. 1994, 1995, 1997; Wechsler and Isaac 1991). The misuse of alcohol by college students is associated with date rape and other violent behavior, poor academic performance, vandalism, injury, high-risk sexual behavior (Eigen 1991; Wechsler and Isaac 1991; Presley, Meilman, and Lyerla 1995), and even death (Associated Press 1997).

The study of college drinking, however, has relied primarily on self-report measures (see Thombs, Olds, and Snyder 2003), and rarely are such measures corroborated with objective measures of consumption (e.g., blood alcohol concentration [BAC]). Self-reported alcohol consumption may be subject to error (Harrell 1997), in part because such measures tend to be reflective and because alcohol, by its very nature, can impair the ability to recall information. Researchers have indicated the importance of developing means of objectively measuring college drinking in field settings (e.g., Boyd and Faden 2002; Cooper 2002; Dowdall and Wechsler 2002).

PREVIOUS BREATH-TEST FIELD SURVEYS

There have been relatively few field studies of college drinking that have used objective measures of alcohol consumption (e.g., Geller, Kalsher, and Clarke 1991; Voas et al. 2002; Thombs, Olds, and Snyder 2003; Foss et al. 2003), and most of these have been developed during the past 6 years. Starting in 1997, researchers at the Pacific Institute for Research and Evaluation began a breath-test field survey of young U.S. residents who cross the border from San Diego County to Tijuana, Mexico, on weekend nights to take advantage of the lower legal drinking age (18 years), inexpensive alcohol, and perceived loose alcohol controls (Lange et al. 2002). An estimated 14.2%, or more than 1,000 per weekend night, were college students.

The methodology (described in Lange, Lauer, and Voas 1999) sampled individuals selected at random from the stream of pedestrian and driver traffic returning to the United States through the border facility at San Ysidro, California. The complex survey design and the weighting of cases to reflect the population of late-night returning crossers allowed us to produce population estimates of heavy drinking by young U.S. residents in Mexican bars. The results of the research indicated that the problems with cross-border drinking in San Diego County were more severe than initially perceived and

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were used to support intervention and media advocacy activities in San Diego County (Voas et al. 2002; Lange and Voas 2001). Recently, the Pacific Institute for Research and Evaluation has adapted its field survey methodology to other border locations between the United States and Mexico, as well as to rave and electronic dance music events.

Also starting in 1997, Foss, Marchetti, and Holladay (2000) and Foss et al. (2003) began a breath-test field study of college students both on- and off-campus at the University of North Carolina–Chapel Hill. For this study, the researchers evaluated a social norms program designed to reduce drunk driving and heavy drinking among college students. The survey methodology involved dividing the campus into four geographically distinct routes that passed by every residence hall, fraternity, and sorority on or near the campus. Off-campus apartment complexes that housed students were included as well. Interview teams followed these routes and, at each residence, sampled individuals or groups of individuals who passed through. Participants were asked to describe their activities during the evening, the amount of alcohol consumed, and their methods of transportation. Participants also provided a BAC breath sample. The results generated from this field survey indicated a decrease in college drinking at Chapel Hill relative to a comparison university that did not receive a social norms campaign. An interesting detail of this research was that objective BAC data, at times, appeared more sensitive than did self-report data.

In 2001 to 2002 at a public university in Ohio, Thombs, Olds, and Snyder (2003) conducted a breath-test field survey specifically to examine the relationship between self-reports of heavy episodic drinking and objective BACs. The research methodology covered the six housing complexes at the host university. The research schedule rotated so that the time spent by the research team at each complex varied each night. The interview team recruited individuals, within 10 yards of the entrance to their housing complex, to participate in an anonymous alcohol study. Those who agreed were asked to provide demographic information, as well as to describe their drinking behaviors, estimate their BACs, and finally provide a breath sample for a BAC test.

COLLEGE CIRCUIT SAMPLING FIELD SURVEY

This report is on a field survey methodology developed as a tool to evaluate several intervention strategies (e.g., driving under the influence enforcement campaign, anti-cross-border drinking campaign) at San Diego State University (SDSU), a large public university in Southern California. This

methodology was designed to collect objective data on college student drinking (BACs) from natural drinking environments (i.e., nonlaboratory). Our methodology shares some of the qualities used by Foss et al. (2003); for example, we strategically and randomly placed interview teams along prescribed routes throughout campus. This sampling strategy was used to recruit participants not only in front of dorms and residence halls but also in front of dining halls, on pathways, and in other areas commonly traversed by students. We also adapted elements of our border survey into this design by recording overall counts of students (including those who were never approached to participate) who were seen along the routes to weight our data appropriately.

METHOD

OVERVIEW

Forty-six discrete geographic "sampling segments" were identified on the SDSU campus. The sampling segments were selected from areas with high probability of foot traffic on weekend nights (e.g., around dorms, dining halls, parking lots, off-campus eateries, and Greek houses). A path was devised that connected each segment to form a circuitous route. On data collection nights, research staff would travel the route and, at each segment, randomly sample one naturally occurring group of young people and invite them to participate. Counts of the total number of persons in each sampling segment (participants as well as nonparticipants) were recorded. The interview included questions on drinking activity during the evening, as well as a BAC breath test.

POPULATIONS OF INTEREST

Formally, our population includes young people who are on or around campus late on weekend nights. Although the focus of our research clearly is on college drinking, not all college students drink. We are interested in being able to make statements about nondrinkers as well and to examine differences between drinkers and nondrinkers in the population. Furthermore, the phenomenon of campus drinking may include nonstudents. College students may have nonstudent friends who participate in drinking behavior on or around campus, or nonstudents may come to campus uninvited to find parties. Thus, our population will not be limited to students per se.

As operationalized, our population of interest may be defined in two ways; the differences between these definitions have implications for how the data are used to produce generalization estimates. The broad operational definition of our population includes young people who travel on or around campus on weekend nights. This definition excludes students who stay in their residences on weekend nights, as well as students who live off campus and go out to off-campus locations. We do include, however, young people who travel on or around campus on weekend nights but who do not come in contact with the sampling route at the same time as the survey team.

One limitation to using this definition is that the size and characteristics of the population are unknown. Furthermore, the geographical boundaries of the population are ill defined, and they were not specified when the survey originally was designed. Although sampling segments are included in nearby off-campus areas, it is not clear to what broader population of off-campus areas these locations generalize. Many ecological survey methods often obtain population estimates by first sampling geographic spaces, estimating variables of interest within those spaces, and then expanding the surveyed spaces to a larger geographical region. Because our circuit route and sampling segments do not reflect a random sample from a known population of geographical spaces, this method of estimation is not readily available to us.

Given the limitations of our broad operational definition, we have identified a more narrow definition as well. The narrow operational definition of our population concerns only those individuals who are eligible to be sampled, that is, only those who are in a sampling segment at the same time as the research staff. This definition excludes young people who travel across campus late at night but who were not "at the right place at the right time." Unlike our broad operational definition, for which the population size and characteristics are unknown, we have information regarding the narrow operational population. The survey methodology includes recording counts and observable descriptives from all individuals in each geographic segment, whether they were approached to participate or not.

SAMPLING STRUCTURE

Data collection occurred on 38 weekends (a total of 75 Friday and Saturday nights) between May 2000 and May 2003 and produced 4,816 interviews. The weekends on which data collection occurred were randomly sampled from among the total of 108 possible weekends (comprising the duration of 3 academic school years). No data were collected during June, July, and August. On 1 weekend in October 2002, data collection for the

scheduled Friday was cancelled because of rain. The survey was conducted between 8 p.m. and 3 a.m. on both Friday and Saturday.

For the survey, we first identified 29 geographic "sampling segments" on the university campus and in the surrounding neighborhoods (see Figure 1, locations 1-28[1]). These segments were not necessarily contiguous but were continuous, and each had a fixed central location with established boundaries. The specific segment locations were chosen from among locations that pedestrian college students would likely traverse on Friday and Saturday nights. For example, sampling segments included areas in front of residence halls, street corners between off-campus bars and campus, and locations around the student union. Sampling segments were selected from a variety of locations to ensure that a representative sample of students who lived in, or were visiting, campus residences could be collected from these locations. Geographic sampling segments were linked to form a circuitous route. By walking this route, a person would pass through each sampling segment and return to his or her original location.

On each survey night, two or three teams of two survey staff followed the circuit route through the sampling segments. Each team began at a different sampling segment, and over the course of data collection, each team completed the route (on average) three times; no team made more than five complete circuits on a given night.

CHANGES TO THE SAMPLING STRUCTURE

During summer 2002, the campus administration created a new "fraternity row" and moved all fraternity/sorority students to a new, centralized location. To accommodate this geographic change, 18 additional segments were added to the circuit to cover the route to fraternity row and back to the starting point. The original segments remained unchanged (see Figure 1, locations 29-46).

SAMPLING PROCEDURE

Before entering each sampling segment, an interview team would receive instructions from their handheld computer indicating how many paces (generated randomly) to walk into the segment before attempting to recruit participants. After stepping the appropriate number of paces into the segment, the survey team would stop and approach the closest person or group to them and ask them to participate in a voluntary, anonymous, and confidential survey.

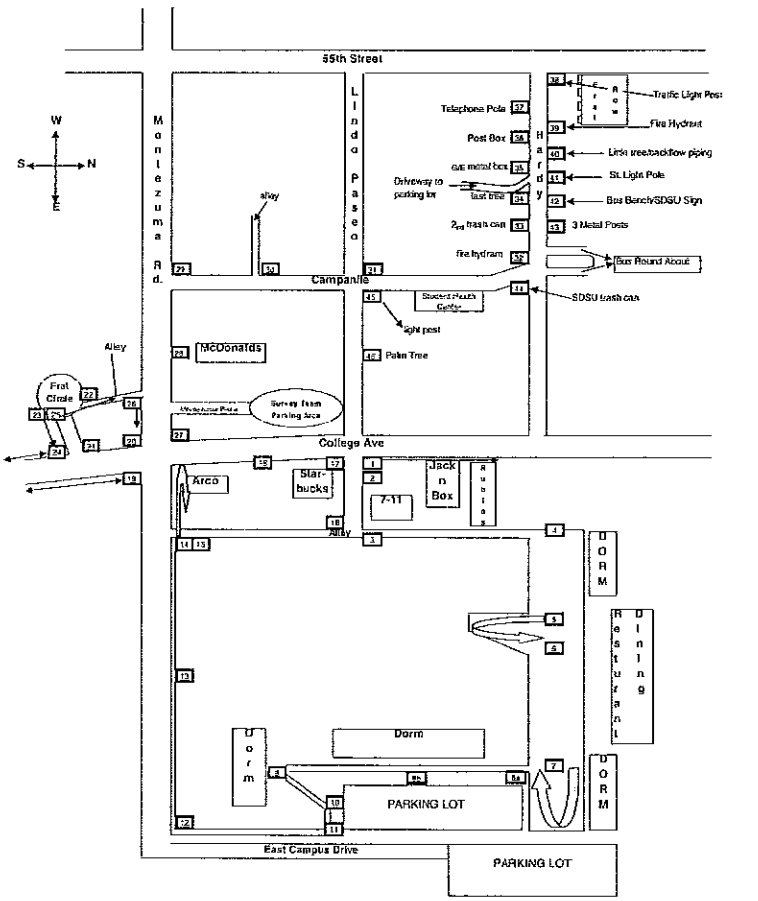

Figure 1: San Diego State University Survey Route (not to scale)

We sampled entire groups of participants, rather than individuals, to maintain higher response rates. Based on our border survey experience, we felt students would be more likely to participate in the survey if they were not separated from their peers.

Potential participants were offered a coupon for a slice of pizza and a soft drink at a pizzeria near campus for taking part in the survey. If the closest randomly selected person(s) did not agree to participate, this would be

recorded as a "whole-group" refusal, and the team would then approach the next person(s) closest to them within the same segment. This process continued either until a group (or individual) agreed to participate or until no one else was left in the segment.

If a person(s) agreed to participate, then the survey team determined whether the group qualified: One person within the group had to be both an SDSU student and between 18 and 30 years old. If the group had a qualifying member, then the whole group was allowed to participate (regardless of their college affiliation) if they were between 18 and 30 years old. Once a student group was selected, one team member would approach the group and ask them to participate in a brief survey on college drinking. Participants were told that in addition to answering questions, they would be asked to provide a breath sample for a BAC test.

While one team member was recruiting students to take part in the survey, another team member was counting the total number of students who were in or traveling through the sampling segment at the time. These population counts were used to weight the individual cases in data analysis.

SURVEY QUESTIONS

Individuals who agreed to participate completed an oral interview with a survey staff member. Participant responses were entered directly into a handheld personal computer. Research questions fell in four broad categories: (a) basic demographics (age, sex, race/ethnicity, etc.), (b) student status (class, housing situation/location, whether they belonged to fraternity/sorority, etc.), (c) their drinking plans for the evening (their original plans for the evening, how much they intended to drink), and (d) their activity that evening (how much they consumed, the type of event or place from which they were returning, method of conveyance to and from that event/location, etc.). In addition, participants provided a breath sample for an anonymous BAC test. The BAC testing units (CMI Intoxilyzer 400, Owensberg, KY) did not display the participant's BAC value but rather stored a three-digit reading internally. The morning after data collection, the survey staff downloaded the BAC data and merged it with the survey data.

ANALYSIS AND ESTIMATION

Although in this article we describe only sample characteristics, data collected with this survey method may be used to make statements regarding the

population. The analytic approach to making these estimations, and the consequent assumptions and limitations, depends on which operational definition of the population is being considered. In the case of our narrow operational definition, the population consists only of those individuals present in sampling segments at the time of sampling; segments, therefore, are considered fixed, and estimation approximates that of the stratified random sample. Each survey night, within each level of strata (e.g., day of week by time of night by geographic location), a participant group is randomly sampled from the total numbers of groups (whose value is known) in that stratum.

Because data are collected from groups of participants, analysis of individual-level data requires analytic procedures that accommodate the nested structure (such as generalized linear mixed modeling using PROC MIXED in SAS). Case weights for our narrow operational population definition can be obtained by dividing the total population count recorded in each stratum by the number of individuals sampled within that stratum.

Although it is clear that these estimates may not reflect the level of on-campus drinking as a whole, we believe that they still are useful. This is true particularly because we believe that late-night drinkers, the group of highest interest, are likely to be sampled using our design. The survey was developed to obtain objective measures of alcohol consumption by students for the purpose of evaluating the efficacy of alcohol-prevention interventions on campus. Even if our circuit survey cannot generalize to the entire population of late-night campus drinkers, it is reasonable that changes in drinking behavior on campus will be reflected in the survey data.

Generalizing estimates produced from our sample data to our broader operational definition of the population may be problematic. At the heart of the issue is that the population described by our narrow population, from which our data were randomly selected, itself is a sample from the broader population. However, this sample was not drawn randomly, and despite our efforts to select segments that would produce a representative sample, it is not obvious whether this is the case. Consequently, not only would our error estimates be biased (because we have not accounted for the double sampling), but the point estimates derived from our sample may be biased as well. Thus, until we are able to make statements regarding the representativeness of our sample data to the broader population, we will refrain from using the survey to describe the behavior of late-night campus pedestrians in general.

TABLE 1: Participant Sample by Day of Week and Time of Night

	Total			
Time of Night	*Friday*	*Saturday*	n	%
8:00–8:59 p.m.	381	360	741	15.3
9:00–9:59 p.m.	260	333	593	12.3
10:00–10:59 p.m.	311	333	644	13.4
11:00–11:59 p.m.	447	416	863	17.9
12:00–12:59 a.m.	390	460	850	17.6
1:00–1:59 a.m.	362	301	663	13.8
2:00–2:59 a.m.	208	236	444	9.2
Invalid time	12	6	18	0.4
Total	2,371	2,445	4,816	

RESULTS

REFUSALS

Because entire groups were recruited to participate at a time, we decided to calculate refusal rates at the whole-group level. Unfortunately, whole-group refusals were not recorded during data collection for the fall 2000 semester; therefore, refusal rates were calculated using data from the spring and fall semesters from 2001 to 2003.

Between 2001 and 2003, 3,874 participant groups (representing 81.8% of all participants) were randomly sampled. Of these, 336 (8.7%) were not eligible to participate, and 315 (8.1%) groups exited the segment before being contacted by research staff, leaving a total of 3,223 eligible groups that research staff attempted to recruit. A total of 1,084 participant groups refused, yielding a participation rate of 66.4%.

In addition, we examined compliance within groups that agreed to participate. Although a group may have agreed to take part in the survey, not all group members agreed to provide a breath sample. The BAC participation rate among members of recruited groups was 85.0%.

PARTICIPANTS

Between May 2000 and May 2003, a total of 4,816 students (from 2,367 groups) participated in the field survey. The sample size generated from this survey is depicted in Table 1 as a function of weekend day and time of night.

TABLE 2: Participant Sample by Sex and Race/Ethnicity

	Sex			
Ethnicity	*Male*	*Female*	*Missing*	*Total*
White	2,293	1,206	3	3,502
Hispanic	340	155		495
Asian	171	107	1	279
Black	137	56	1	194
Other	141	64	1	206
Mixed	99	40	1	140
Total	3,181	1,628	7	4,816

The demography of the sample (in terms of sex and ethnic/racial distribution) is reflected in Table 2.

In addition, we collected information on students' class level, fraternity status, athletic status, and housing. The majority of participants were freshmen (62.5%), followed by sophomores (18.9%), juniors (12.5%), seniors (5.1%), and graduate students (1%). Approximately one fifth of the students (20.6%) indicated belonging to a fraternity or sorority, and 8.8% indicated that they were athletes for a university team. Most participants (64.7%) lived on campus; 25.3% lived in an off-campus apartment or house, and 3.6% lived in a fraternity/sorority house.

CROSS-CAMPUS TRAVEL

Participants were asked to indicate (a) the type of location from which they were coming and (b) the type of place to which they were going. More than 99% of participants responded to these questions. Possible responses included (a) my place, (b) friend's place, (c) family's home, (d) study location, (e) bar, (f) private party, (g) restaurant, (h) store, (i) outdoor recreation area, (j) transportation center, and (k) other.

The frequencies of responses to the "coming from" and "going to" questions are provided in Table 3. The results reveal that although participants most frequently were returning from, or heading to, their residences or a friend's residence, many indicated private parties as a location. Examination of "coming from" and "going to" questions in combination indicates that 43.3% of participants reported coming from or going to a private party or bar.

TABLE 3: Origin and Destination of Participant Sample

	Location From Which Participants Were Leaving		*Location to Which Participants Were Heading*	
	n	%	n	%
My place	1,748	36.3	1,729	35.9
Friend's place	965	20.0	820	17.0
Family's home	133	2.8	36	0.7
Study location	37	0.8	19	0.4
Bar	237	4.9	251	5.2
Private party	846	17.6	1,046	21.7
Restaurant	258	5.4	428	8.9
Store	172	3.6	136	2.8
Outdoor recreation area	89	1.8	69	1.4
Transportation center	2	0.0	2	0.0
Other	292	6.1	238	4.9
Missing	37	0.8	42	0.9
Total	4,816	100.0	4,816	100.0

STUDENT DRINKING

Participants were asked to provide a breath sample for an anonymous BAC breath test. Examination of the student BACs indicated more than 51.0% of men age 20 or younger and 59.4% of men age 21 or older registered positive for alcohol. For women, 37.7% who were age 20 and younger and 31.6% who were age 21 and older had nonzero BACs.

Mean student BACs are provided in Figure 2. Mean student BACs for those who registered nonzero BACs are provided in Figure 3.

SUMMARY

Researchers have begun to develop methodologies to obtain objective measures of college drinking in ecologically valid settings. Field surveys involving BAC breath tests have been used (e.g., Geller, Kalsher, and Clarke 1991; Thombs, Olds, and Snyder 2003; Foss et al. 2003) on college campuses and at the border between the United States and Mexico (e.g., Voas et al. 2002). Such research designs potentially can paint a more accurate picture of alcohol consumption on campus, detect trends and changes in drinking (as a function, for example, of some intervention or a policy change), and allow comparisons between different measures of consumption.

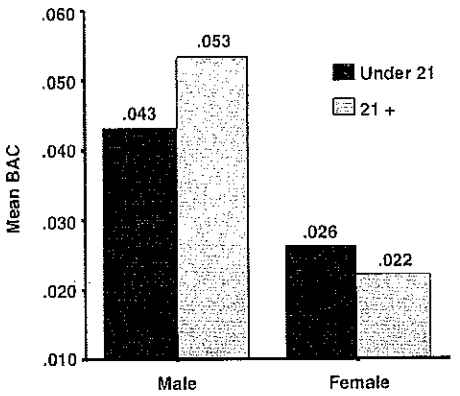

Figure 2: Blood Alcohol Concentrations (BACs) of Sample Participants by Sex and Age

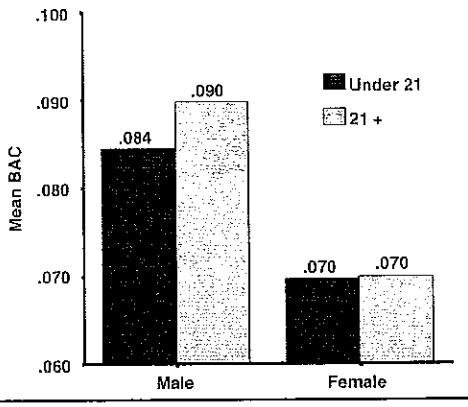

Figure 3: Blood Alcohol Concentrations (BACs) of Sample Participants With Nonzero BACs by Sex and Age

The research methodology that we used at SDSU is an adaptation of the approach of Foss et al. (2003; i.e., generating a "sampling route" along which survey staff recruited student participants), combined with some elements from our border survey, such as recording population counts of students from which participants are randomly sampled. In our survey, however, the route connects sampling segments that include not only dormitories and dining halls but also fraternities, off-campus eateries, and walkways that connect on-campus residences to off-campus neighborhoods. We sampled one peer

group of students from the population of students who were present at each sampling segment.

At face value, the circuit sampling approach described in this article loosely mirrors survey methods used in ecological research, such as line transect and spatial sampling (see, e.g., Buckland et al. 1992; Seber 1992; Thompson 1992). In a line-transect survey, for example, an observer follows a line (similar to our circuit route) and notes the prevalence and location of plants and animals detected along the line. In spatial surveying, data are collected from specific geographic sites (similar to our sampling segments), and these estimates are generalized to other sites using geographic indicators as informative covariates.

Although our survey method was similar to those ecological approaches in that data collection was governed by geographic boundaries, there are important differences between the methods. In ecological surveys, not only is geography an important variable by itself, but it is also the unit of expansion by which researchers derive population estimates. Using these methods, survey researchers typically attempt to record every observable occurrence of an object of interest (e.g., plant, animal, mineral, etc.) within a specific geographical space and then extrapolate population counts by expanding the geography to broader (or different) regions of interest (see, e.g., Cressie 1991; Diggle 1983). For ecological surveys, the issue of detectability is important; failing to observe or detect members of a species along a transect may underinflate overall density estimates.

In our college circuit survey, we currently do not conceive of geospace as a unit of extrapolation.[2] Although we used geographic boundaries to assist the sampling of individuals, we did not expand per se our sampling segments to other geospatial locations. Instead, we expanded our sample of individuals to population counts that are known (in the case of our narrow operational definition) or that can be approximated (in the case of our broad operational definition). Unlike ecological survey methods, the issue of detectability is not particularly important. When relying on our narrow operational definition of the population, we assume all individuals in the sampling segment are detectable.

LIMITATIONS

Our methodology also provided a representative sample of late-night college drinkers. Several factors indicate that we sampled our desired population. More than 40% of our sample was heading to or returning from a party

or bar, and for those who did consume alcohol, mean BACs for men were higher than 0.08 and for women were at 0.07. One limitation of the circuit survey, however, is that the method is strongest for estimating the drinking behavior of only those individuals who were in a sampling segment at a time when research drew a sample (i.e., our narrow operational definition of the population). Whereas these estimates nevertheless may be useful for the purpose of evaluating change in late-night drinking behavior on campus, they do not necessarily generalize to other times and other locations on campus. Methods for expanding the survey data to our broader definition late-night campus drinkers are more complicated and rely on estimates of population values rather than actual counts. Furthermore, even our best possible estimates (using the broad definition) reflect only drinking on campus or drinking in the surrounding neighborhoods by students who live on campus. Students who stay in their dorms to drink and who reside off campus and drink off campus will not be adequately captured by this survey.

A second limitation of the field survey is that it is sensitive to geographic changes that might displace foot traffic on campus on weekend nights. For example, the addition of a new housing structure, parking garage, or off-campus bar might divert students to campus locations not covered by the sampling segments. Before fall 2002, SDSU constructed a new fraternity row. This addition could have potentially affected the quantity and characteristics of participants being sampled along our existing route. To accommodate this, we extended the route and added sampling segments but kept the original route intact. Nevertheless, future substantive analysis of data collected from our field survey following the fall of 2002 may reveal what appears to be a decrease in campus drinking that actually is the displacement of campus foot traffic on weekend nights.

CONCLUSION

The methodology described in this article reflects one of few attempts to obtain ecologically valid, objective measures of alcohol consumption on college campuses. Future studies will report on results generated from the data, including population estimates of campus drinking at SDSU, examinations between objective and self-report measures of consumption, and evaluations of intervention activity.

NOTES

1. Location 8 is represented as Locations 8a and 8b.

2. This is not to say that procedures of geographical sampling and estimation have no place in our circuit sampling method. However, we have not contemplated analyzing the data using geospatial methods.

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