Published in final edited form as:

Addiction. 2019 July ; 114(7): 1303–1308. doi:10.1111/add.14603.

Feasibility of a mail-in, self-administered dried blood spot collection method in national, population-based alcohol surveys in the U.S.

Martinez Priscilla, PhD¹ and Sarah E. Zemore, PhD¹

¹Alcohol Research Group, Public Health Institute, Emeryville, CA, USA

Abstract

BACKGROUND AND AIMS: Including a low-intensity blood collection method in population-based alcohol studies would advance our ability to study biological mechanisms related to alcohol. However, the likelihood of participation in such a blood collection method remains understudied. This study's primary aims were to (1) estimate the return rate of mail-in, self-administered dried blood spot (saDBS) samples in national surveys and (2) test correlates of returning a sample.

DESIGN: Re-contact of all eligible participants from two telephone, population-based alcohol surveys followed by chi-square tests and multivariate logistic regression analysis.

SETTING: Non-institutionalized U.S. population in all 50 states and Washington, D.C.

PARTICIPANTS: Adults aged 18+ who reported drinking at least one alcoholic beverage in the past 12 months (assessed 2017–2018). Contact was made with 680 eligible participants, and 257 consented.

MEASUREMENTS: The return rate of saDBS samples was defined as the proportion of returned samples among those who were eligible and contacted. Key correlates examined were gender, age, race/ethnicity, and education.

FINDINGS: Among the 680 eligible people contacted, 179 (26.3%) returned a saDBS sample. Blacks (OR = 0.60, 95% CI = 0.37–0.98), Latinos (OR = 0.41, 95% CI = 0.23–0.71) and those with a high school education or less (OR = 0.49, 95% CI = 0.31–0.79) were less likely to return a saDBS sample.

CONCLUSIONS: The likelihood of participating in mail-in, self-administered dried blood spot (saDBS) sampling among drinkers in the U.S. general population appears low, and Blacks, Latinos, and people with lower levels of education appear less likely to provide a saDBS sample compared with Whites and people with higher levels of education.

Corresponding author: Priscilla Martinez, 6001 Shellmound St., Suite 450, Emeryville, CA 94968, Ph: 510-898-5860, pmartinez@arg.org.

Conflict of interest declaration: None.

INTRODUCTION

The inclusion of blood samples in alcohol studies can enhance our understanding of alcohol use and problem drinking. Among other advantages, it allows for the study of the physiology of alcohol use and problem drinking¹, and for the objective verification of self-reported alcohol use². The inclusion of a cost-effective, low-intensity blood collection method in population-based studies in particular would advance alcohol research because of these studies' high representativeness and large sample sizes. Blood specimens from non-clinical population-based samples are often lacking, however, due to the financial and practical demands of traditional venipuncture.

The resource challenges of traditional venipuncture can be addressed by dried blood spot (DBS) technology³. DBS is an alternative to venous blood draws, and involves obtaining capillary blood through pricking the finger and blotting the blood onto filter paper. This method dramatically reduces personnel, storage, and shipping costs, and is an accepted means of collecting blood samples for physiological tests. Further, a DBS sampling kit intended for self-administration and shipping via standard mail ("Hemaspot™") has been recently developed. An in-house usability study of Hemaspot™ found that 25/30 (83%) of testers returned completed kits⁴. Given its relatively recent development, however, the utility of Hemaspot™ for use in large, national studies has not been evaluated.

Internationally, a few studies have investigated the return of DBS samples. A clinic-based study from the UK observed that 20/30 (67%) of people who received a locally-produced self-administered DBS (saDBS) kit returned a completed kit by mail⁵. In Norway, Sakhi et al examined the feasibility of mail-in saDBS samples in a population-based study among women aged 50 plus, and observed a 71% return rate with N=3,263⁶. In the U.S., two studies have used DBS collection with filter paper cards: a population-based survey⁷ and a study among adult outpatients⁸. However, both had trained interviewers administer the blood spot collection, and neither required mail-in follow-up. One study among female cancer cases and controls examined mail-in saDBS collection and obtained blood sample return rates of 37% among cases and 28% among controls⁹.

The aforementioned studies suggest that mail-in saDBS is feasible. However, to our knowledge, the return rate of saDBS samples has not been assessed in a telephone-based, general population survey sample in the U.S. Thus, the two primary aims of this study were to (1) estimate the return of saDBS samples using the Hemaspot™ in a follow-up sample of two telephone-based, general population alcohol surveys, and (2) test correlates of returning a DBS sample. A secondary aim was to describe user experiences with the Hemaspot™.

METHODS

Design

We conducted a cross-sectional study drawing from two national, population-based U.S. surveys. We invited eligible people to complete and return a saDBS sample. We measured the proportion of people who returned a saDBS sample among those whom we contacted and confirmed were eligible to participate, which included those who agreed to participate

and those who did not. We compared people who returned a sample with those who did not on key characteristics.

Sample

We collected data by re-contacting cell phone and landline participants of the 2014–2015 National Alcohol Survey (NAS) and an add-on survey to the 2015 NAS called the National Alcohol's Harms to Others Survey (NAHTOS). Participants of the 2015 NAS/NAHTOS were eligible for this study if they agreed to be re-contacted, reported being Black, White, or Latino, and reported drinking at least one alcoholic beverage in the past 12 months. We chose these 3 racial/ethnic groups because they comprise the largest racial/ethnic groups in the NAS/NAHTOS. Based on these criteria, 2,070 respondents were eligible. The Institutional Review Boards of the Public Health Institute, Oakland, CA and ICF Macro, Inc., Fairfax, VA (the fieldwork agency) approved all study protocols.

Study materials and procedures

The Hemaspot™ Blood Collection Device is manufactured by Spot*On Sciences and is patent-pending (see Figure 1). The dried sample can be shipped by standard mail with no special provisions.

Eligible participants were approached by phone in two waves: November through December of 2017, and March through April of 2018. Up to 8 attempts were made to reach respondents. The interviewer began by asking questions to verify that the person reached was the 2015 NAS/NAHTOS respondent. Participation in the study required consent to the telephone interview, receiving a saDBS kit, and returning a blood sample by mail.

Immediately following consent, participants completed the computer-assisted telephone interview, covering alcohol use, previous experience with DBS, and health status. Interviews lasted approximately 20 minutes, and at the end, participants provided a mailing address. Staff then mailed each respondent a saDBS kit and paper-based User Experience Survey (UES); participants were instructed to complete the UES after using the saDBS kit.

All participants received a reminder message to complete and return their saDBS sample approximately one week after the saDBS kit was mailed to them. A second reminder was sent approximately one week after the first reminder to those who had not yet returned their saDBS samples. Participants received \$40 gift codes within 7 days of delivery of their samples. Blood samples will be tested for inflammation indicators (not reported here). Quality control measures confirming that the DBS samples are blood, and not another liquid, will be included as part of standard laboratory procedures.

Measures

We measured the return rate of saDBS samples as the ratio of people who returned a saDBS sample over the total pool contacted by phone and deemed eligible, including those who agreed to participate in the study and those who did not. The brief UES assessed participants' experiences using the saDBS kit, asking about confidence providing a sample,

desire for changes to instructions, and likelihood of using saDBS again and recommending it to a friend.

Statistical Analysis

Chi-square tests were used to compare those who returned a saDBS sample to those who did not on age, gender, race/ethnicity, and education. We used multivariate logistic regression to examine the adjusted effects of these characteristics on saDBS sample return. Finally, we summarized responses to the UES items and compared them across demographic groups using chi-square tests of independence. We used STATA version 15 for all analyses¹⁰.

RESULTS

Of the 2,070 eligible respondents of the 2015 NAS/NAHTOS, we spoke to and verified respondent status with 680 (32.8%). Of the remaining 1390 individuals, we could not contact 506 (24.4%) either because the number was non-working, a fax/modem, always busy, never answered, or not a residence. The other 884 (42.7%) had working numbers, but we encountered only an answering machine, or were unable to verify who we were speaking to. Of the 680 confirmed eligible, 257 (37.8%) agreed to participate in the study, and 179 (26.3%) returned a saDBS sample.

Table 1 shows the sociodemographic characteristics of the 179 people who returned a sample compared to the 501 who did not. We observed smaller proportions of Blacks, Latinos, and people with a lower level of education among those who returned a sample compared with those who did not. In a multivariate analysis of saDBS sample return, Blacks and Latinos (vs. Whites), and those with a high school education or less (vs. college graduates or above), had significantly lower odds of returning a saDBS sample (see Table 2).

Of the 179 people who returned a saDBS sample, 164 (90.6%) also returned a completed UES. Table 3 shows the frequencies of item responses by selected characteristics. Overall, 151 people (93.8%) noted they were very or somewhat confident providing a sample, and 58 (36.7%) wanted additional instructions. Blacks were more likely to report that they were not very confident or not confident at all (19.2%) providing a sample compared to Latinos (5.9%) and Whites (3.4%), $p=0.01$. A higher proportion of people with a high school education or less reported that they did not want any other type of instructions compared to people with a college degree or higher (75.0% vs 54.6%, $p=0.04$).

DISCUSSION

This study aimed to estimate the return of mail-in, saDBS samples in a follow-up sample of participants from two national, telephone-based, alcohol surveys. We observed that approximately 26% of those who were confirmed eligible returned a saDBS sample. We also observed that Blacks were nearly 60%, and Latinos were 40%, less likely than Whites to return a sample, and those with a high school education or below were 50% less likely than those with a college degree or above to return a sample.

In previous, related work, the mail-in return rates for saDBS samples ranged from 28% among controls in a U.S. case-control breast cancer study⁹ to 71% among a Norwegian population-based sample of women aged 50 plus⁶. Our return rate of approximately 26% is comparatively low. Moreover, we observed that Blacks, Latinos, and people with lower levels of education were less likely to return a sample. These observations may be due to several reasons. Previous studies have suggested skepticism among Blacks and Latinos in the U.S. around engaging in research involving genetic testing and biobanking^{11,12}, often because of a mistrust of the medical establishment^{13,14}. Further, the current socio-political climate surrounding the Latino community in the U.S. may further reduce willingness to participate in government-funded research. Also, 37% of those who returned a UES noted additional instructions would be helpful, suggesting that the instructions may have been inadequate for this population. Relatedly, future work on saDBS collection may want to consider literacy levels. Low return rates of biosamples in population-based surveys are of concern because they compromise the generalizability of findings, and this is exacerbated when return rates are biased by demographic subgroup.

When comparing our return rate to those from the studies mentioned above, it is important to note that these studies used the number of people who consented and received a kit as the denominator when calculating return rates. If we use this approach, our return rate is approximately 70% (179/257). This information may be useful for studies that are more concerned with examining the relationship between constructs than with generalizability. Also, from the perspective of a 70% return rate, the bottleneck for engaging participants was the response rate, which was just 37.8% (257/680). Response rates for epidemiologic studies have been steadily declining in the U.S. over the past 40 years¹⁵, although an approximately 40% response rate is still comparatively low¹⁶. Thus, studies less concerned with generalizability and interested in collecting biosamples could consider including targeted efforts to improve agreement to participate, while anticipating a reasonable return rate among those who provide consent and receive a sample collection kit.

This study has limitations that should be noted. First, we sampled from people who had already completed a telephone-based alcohol survey averaging 46 minutes in length¹⁷, suggesting we may have sampled people who are inclined to participate in survey research. Second, we included only participants who reported drinking in the last 12 months, so we cannot speak to the return of saDBS samples among abstainers. Third, this study had a relatively small sample size due to limited eligibility criteria, so results from a larger sample may differ. Finally, the saDBS samples collected have not yet been tested, and therefore their viability for laboratory assays cannot be determined by this work. Notably, the source of blood samples collected from a distance cannot be verified, which is a limitation of this collection method generally.

Nonetheless, to the best of our knowledge, the present study is the first to determine the return rate of a mail-in, saDBS sample in large, telephone-based, national U.S. surveys. Based on our findings of a 26% return rate of saDBS samples and nearly 40% agreement to receive a saDBS kit, we conclude that mail-in, self-administered dried blood spot collection is feasible but problematic. Efforts to improve participation when adding such a blood collection component need to be made, particularly in addressing the participation of Latinos,

Blacks, and people with lower levels of education. Future work may consider studying different instruction formats, including more follow-up, and expanding recruitment efforts. This is especially important to ensure that all segments of society participate in and benefit from advancements in alcohol and public health research.

REFERENCES

1. Voigt RM, Forsyth CB, Keshavarzian A. Circadian disruption: potential implications in inflammatory and metabolic diseases associated with alcohol. *Alcohol Res* 2013; 35(1): 87–96. [PubMed: 24313168]
2. Allen JP, Litten RZ, Strid N, Sillanaukee P. The role of biomarkers in alcoholism medication trials. *Alcohol Clin Exp Res* 2001; 25(8): 1119–25. [PubMed: 11505042]
3. McDade TW, Williams S, Snodgrass JJ. What a drop can do: dried blood spots as a minimally invasive method for integrating biomarkers into population-based research. *Demography* 2007; 44(4): 899–925. [PubMed: 18232218]
4. Spot On Sciences. HemaSpot Usability Study Summary. Austin, TX: November; 2013.
5. Chakrabarty G, Rice P, Forton D. To improve screening of contacts of chronic Hepatitis B cases through a newly developed self-administered dried blood spot test for Hepatitis B [Accessed: 2014-09-29 Archived by WebCite® at <http://www.webcitation.org/6SxaKXH2L>]. Best Practice Sharing Event Cambridge, UK; 2012.
6. Sakhi AK, Bastani NE, Ellingjord-Dale M, Gundersen TE, Blomhoff R, Ursin G. Feasibility of self-sampled dried blood spot and saliva samples sent by mail in a population-based study. *BMC cancer* 2015; 15: 265. [PubMed: 25886002]
7. Williams SR, McDade TW. The use of dried blood spot sampling in the national social life, health, and aging project. *J Gerontol B Psychol Sci Soc Sci* 2009; 64(Suppl. 1): i131–i6. [PubMed: 19244547]
8. Fokkema MR, Bakker AJ, de Boer F, Kooistra J, de Vries S, Wolthuis A. HbA1c measurements from dried blood spots: validation and patient satisfaction. *Clinical chemistry and laboratory medicine* 2009; 47(10): 1259–64. [PubMed: 19751141]
9. Bhatti P, Kampa D, Alexander BH, et al. Blood spots as an alternative to whole blood collection and the effect of a small monetary incentive to increase participation in genetic association studies. *BMC medical research methodology* 2009; 9: 76–. [PubMed: 19912630]
10. StataCorp. Stata Statistical Software: Release 15 College Station, TX: StataCorp LLC; 2017.
11. Glenn BA, Chawla N, Bastani R. Barriers to genetic testing for breast cancer risk among ethnic minority women: an exploratory study. *Ethnicity & disease* 2012; 22(3): 267–73. [PubMed: 22870568]
12. Martinez P, Cummings C, Karriker-Jaffe KJ, Chartier KG. Learning from Latino voices: Focus Groups' Insights on Participation in Genetic Research. *The American journal on addictions* 2017; 26(5): 477–85. [PubMed: 28376266]
13. Murphy E, Thompson A. An exploration of attitudes among black Americans towards psychiatric genetic research. *Psychiatry* 2009; 72(2): 177–94. [PubMed: 19614555]
14. Durant RW, Wenzel JA, Scarinci IC, et al. Perspectives on barriers and facilitators to minority recruitment for clinical trials among cancer center leaders, investigators, research staff, and referring clinicians: enhancing minority participation in clinical trials (EMPaCT). *Cancer* 2014; 120 Suppl 7: 1097–105. [PubMed: 24643647] **Suppl**
15. Galea S, Tracy M. Participation Rates in Epidemiologic Studies. *Annals of Epidemiology* 2007; 17(9): 643–53. [PubMed: 17553702]
16. Korcha RA, Polcin DL, Kerr WC, Greenfield TK, Bond J. Pressure and help seeking for alcohol problems: trends and correlates from 1984 to 2005. *Addictive Behaviors* 2013; 38(3): 1740–6. [PubMed: 23261492]
17. Karriker-Jaffe KJ, Greenfield TK, Kaplan LM. Distress and alcohol-related harms from intimates, friends, and strangers. *Journal of substance use* 2017; 22(4): 434–41. [PubMed: 28757806]

Figure 1.
Hemaspot™ cartridge, Source: <https://www.spotonsciences.com/products/hemaspot-hf/>

Table 1.

Selected sociodemographic characteristics of those who did and did not return a saDBS sample.

	No sample return N=501 [†]	Returned a sample N=179	p-value
	n(%)	n(%)	
Age			
20–29	73 (14.8)	22 (12.4)	
30–39	85 (17.2)	31 (17.4)	
40–49	72 (14.6)	28 (15.7)	0.689
50–59	80 (16.2)	36 (20.2)	
60+	185 (37.4)	61 (34.3)	
Gender			
Women	260 (51.9)	100 (55.9)	0.361
Men	241 (48.1)	79 (44.1)	
Race/ethnicity			
White	288 (57.5)	134 (74.9)	
Black	108 (21.6)	27 (15.1)	0.000
Latino	105 (21.0)	18 (10.1)	
Education			
High school or less	151 (30.3)	30 (16.9)	
Some college	139 (27.9)	50 (28.1)	0.001
College graduate or above	209 (41.9)	98 (55.1)	

Note: n's in age and education do not sum to column total due to missing values;

[†]The 501 includes 423 confirmed eligible who did not agree to participate and did not receive a saDBS kit, and 78 confirmed eligible who did agree to participate and did receive a saDBS kit.

Table 2.

Adjusted odds ratios for returning a saDBS sample among those who were confirmed eligible

	OR (95% CI)	p-value
Age		
20–29	ref	-
30–39	1.01 (0.53–1.94)	0.967
40–49	1.14 (0.59–2.24)	0.684
50–59	1.26 (0.64–2.38)	0.481
60+	0.83 (0.47–1.49)	0.542
Gender		
Women	1.19 (0.83–1.70)	0.336
Men	ref	-
Race/ethnicity		
White	ref	-
Black/African American	0.58 (0.35–0.95)	0.030
Latino	0.40 (0.23–0.69)	0.001
Education		
High school or less	0.50 (0.31–0.81)	0.005
Some college	0.82 (0.55–1.24)	0.355
College graduate or above	ref	-

Table 3.
Responses to items of the user experience survey by selected sociodemographic characteristics

	Very/somewhat confident taking sample after reading instructions	Very/somewhat likely to participate in biosample survey again	Very/somewhat likely to recommend blood spot collection kit	Wanted more detailed instructions	Wanted other instructions	Did not want any additional instructions
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Age						
20-29	18 (90.0)	18 (90.0)	16 (80.0)	6 (31.6)	4 (21.1)	11 (57.9)
30-39	25 (96.2)	24 (88.9)	23 (88.5)	2 (7.4)	12 (44.4)	13 (48.2)
40-49	26 (92.9)	22 (78.6)	20 (71.4)	2 (7.4)	7 (25.9)	19 (70.4)
50-59	31 (93.9)	28 (82.4)	29 (85.3)	2 (6.3)	6 (18.8)	24 (75.0)
60+	50 (94.3)	41 (75.9)	39 (72.2)	9 (17.3)	13 (25.0)	33 (63.5)
Gender						
Women	87 (95.6)	74 (80.4)	70 (76.1)	13 (14.4)	29 (32.2)	53 (58.9)
Men	64 (91.4)	60 (83.3)	58 (81.7)	8 (11.8)	14 (20.6)	47 (69.1)
Race/ethnicity						
White	114 (96.6)*	99 (82.5)	95 (79.8)	15 (12.9)	35 (30.2)	70 (60.3)
Black	21 (80.8)	20 (74.1)	19 (70.4)	3 (11.5)	3 (11.5)	20 (76.9)
Latino	16 (94.1)	15 (88.2)	14 (82.4)	3 (18.8)	5 (31.3)	10 (62.5)
Education						
High school or less	26 (92.9)	25 (89.3)	22 (78.6)	4 (14.3)	3 (10.7)*	21 (75.0)*
Some college	38 (95.0)	35 (83.3)	34 (81.0)	5 (12.2)	8 (19.5)	30 (73.2)
College graduate or above	86 (93.5)	74 (79.6)	72 (78.3)	12 (13.6)	32 (36.4)	48 (54.6)

Note: For interpretability, we dichotomized the responses for 4-point Likert scale items into the two categories “very or somewhat confident/likely” and “not very or not at all confident/likely”. Chi-square comparisons are for “very or somewhat confident/likely” vs. “not very or not at all confident/likely”;

* p-value 0.05