Published in final edited form as:

J Rural Health. 2018 March ; 34(2): 193–201. doi:10.1111/jrh.12249.

Address-Based Sampling for Recruiting Rural Subpopulations: A 2-Phase, Multi-mode Approach

Tiffany L. Thomson, PhD¹, Julianna M. Nemeth, PhD¹, Juan Peng, MAS², Bo Lu, PhD³, Amy K. Ferketich, PhD⁴, Electra D. Paskett, PhD⁵, and Mary Ellen Wewers, PhD, MPH¹

¹Division of Health Behavior and Health Promotion, Ohio State University College of Public Health, Columbus, Ohio

²Center for Biostatistics, Ohio State University College of Medicine, Columbus, Ohio

³Division of Biostatistics, Ohio State University College of Public Health, Columbus, Ohio

⁴Division of Epidemiology, Ohio State University College of Public Health, Columbus, Ohio

⁵Division of Cancer Prevention and Control, Department of Internal Medicine, Ohio State University College of Medicine, Columbus, Ohio

Abstract

Purpose—This article describes recruitment of a subpopulation of women in a rural area, extending an existing method of a 2-phase address-based sampling protocol to include a mixed mode approach.

Methods—Phase 1 included a household enumeration questionnaire mailed to randomly selected households (n=1950) in 3 Ohio Appalachian counties to identify members of the eligible subgroup. The second phase of recruitment involved contacting 1 randomly selected eligible woman enumerated by each household, based on return of the questionnaire. These women (n=599) were invited by field interviewers to participate in a one-time in-person health survey.

Findings—Of the women invited to participate, a total of 408 completed the interview. Based on AAPOR RR 1 calculations, the response rates were 44.4% and 70.3% for phases 1 and 2, respectively. Response rates in this study were encouraging, especially for the second phase in-person interview.

Conclusion—We discuss implications for future research using a mixed-mode approach in this subpopulation.

Keywords

address-based sampling; Appalachia; recruitment; rural; special populations

The recruitment of underserved populations into cancer-related research has proven difficult,¹⁻³ with challenges ranging from time demands keeping individuals from participating, to

For further information, contact: Dr. Thomson, 1841 Neil Avenue, Columbus, OH 43210; Thomson.46@osu.edu; Tel: 614-565-6134.

Disclosures: The authors report no conflicts or disclosures.

lack of trust in those outside of one's culture or community, to logistical issues such as lack of transportation to the study site. Those living in Appalachian areas are no exception to these problems.^{3,4} While scholars have found that certain strategies aid in the recruitment of underserved populations, such as involving members of the community, personal contact, and compensation,⁵⁻⁸ the success of recruitment varies by population group and the goal of each study. A call has been put out for researchers to “examine the effectiveness of specific research techniques” to recruit these population groups.³ This paper describes the expansion of a proven technique to recruit subpopulations to research studies; specifically, the subpopulation of Ohio Appalachian women recruited to a study examining the social context of smoking.

The Appalachian region of Ohio is one characterized by lower household income, higher poverty rates, and lower educational attainment than the non-Appalachian region in the state.⁹ There are also marked differences in health between these 2 regions. For example, women residing in the Appalachian region, in particular, experience a 20.8% higher rate of mortality from invasive cervical cancer than non-Appalachian women in the state.¹⁰ Research has documented that cigarette smoking is an independent risk factor for cervical cancer. Women who smoke are about twice as likely as nonsmokers to develop cervical cancer.¹¹ The prevalence of smoking among women in certain Ohio Appalachian counties is upward of 30%¹² compared to 24.2% for all women in Ohio.¹³ Studying women in Ohio Appalachia is important to better understand their overall health behaviors and specifically their use of combustible tobacco. To accomplish this, it was important to obtain a representative sample of current smokers from our subpopulation of interest.

Brick, Williams and Montaquila¹⁴ described a 2-phase, address-based sampling (ABS) approach for subpopulation research. Their 2-phase approach was specifically designed to target households with children, while bypassing the need to survey all households in the sampling frame and to eliminate the need for households to determine which member to sample if the household contained more than one subgroup member. Phase 1 of Brick and associates' 2-phase approach involved mailing a cover letter and screening questionnaire, along with a \$2 incentive, to sampled addresses to determine if the subpopulation of interest resided in the household. Returned questionnaires indicating that a member of the subpopulation resided in the household were then sent a second mailing with a specially tailored survey instrument to be filled out by a specific subgroup member and returned. Results of this 2-phase ABS approach for the mail-only path yielded a 60.6% response at phase 1 and a 71.1% response at phase 2. Similar results were found in subsequent attempts using this approach.^{15,16} Although Brick, Andrews and Mathiowetz¹⁷ have also had success with a single rather than 2-phase mail survey design for rare population groups, they agree with Montaquila and colleagues¹⁸ that a 2-phase design is ideal when within household sampling is needed, and when the survey is lengthy.

Based on the success of the 2-phase recruitment strategy for subpopulations, the present study used a modified version of Brick and associates' ¹⁴ 2-phase mail-based ABS approach, substituting an in-person interview administered survey at phase 2 rather than a mailed survey. The reason to use in-person interviewing for the phase 2 mode was twofold. First, a portion of the phase 2 interview involved gathering egocentric network data which has

traditionally been collected in person^{19,20} and has been proven to be more successful than trying to obtain this data using online surveys.²¹ Second, the phase 2 interview also included a series of gender-based violence exposure items. Research has shown that gender-based violence survivors may benefit from participating in research which directly asks about such exposures, with greater positive gains reported from respondents participating in interview-administered surveys versus written surveys.²²⁻²⁵ In addition, interviewers received training on a Research Interview and Distress Protocol to assure that they would know how to respond if a participant was to experience visible distress at any time during survey administration. Finally, interviewers provided county-specific women's health referral handouts that were personally offered to all participants by the interviewer at the conclusion of the interview. The handouts contained information on where to call or obtain services for many of the health-related topics covered by the survey, including information on local intimate partner and/or sexual gender-based violence crisis intervention programs.

Although the use of mixed modes in surveys is not new,^{26,27} it is uncommon for in-depth interviews to be used as a final mode. However, Wagner and colleagues²⁸ examined the results of using a mixed-mode screening approach on response rates for an in-depth interview. They found that using a mail survey in the screening process was more cost effective than screening only in-person, and that, importantly, there was no harmful effect on the response rates for the in-person interview. The present study displays the results of response rates and demographic composition of a research study using a 2-phased, mixed mode, address-based sampling approach to recruit women in Ohio Appalachia, using a mailed survey at phase 1 and a face-to-face interview at phase 2.

Methods

Sampling Frame

This study was 1 of 4 projects funded in the Ohio State University Center for Population Health and Health Disparities (OSU CPHHD) to examine the causes and contributors to cervical cancer disparity among women residing in Ohio Appalachia. Recruitment took place in Brown, Coshocton, and Lawrence Counties in Ohio, each designated as rural according to the 2010 census rural population and area percent data.²⁹ These counties were chosen based on the availability of existing research infrastructure and trained field staff. The ABS sample was obtained from Marketing Systems Group (MSG), an international survey sample provider, using their enhanced US Postal Service Computerized Delivery Sequence (CDS) File.³⁰ Coverage of all residential addresses in this file is nearly 100%.³¹ The following residential address types were excluded from our address frame: traditional PO boxes not flagged as the only means of receiving mail, seasonal, vacant, educational (off campus housing), and drops (multi-unit dwellings with no unique unit information and one centralized mail drop off). According to MSG Assistant Vice President of Social Science Research (email communication, February 2017), the address type classifications come from USPS and the vacant classification is based on long-term vacancy of 90 days. Exclusion counts were provided by the firm, and they proved to be minimal.

The starting address frame for this study included 2000 residential addresses randomly sampled from each of the 3 Ohio Appalachian counties for a total of 6000 addresses. This

number was derived after taking into account assumed response rate to ensure that the recruitment goal was met. Sample size was stratified by county since each county was sampled separately, and it was not designed to be proportional to the county population size. This decision was made for purposes of analysis in order to maximize the power of the statistical test for county level of analysis.

Sample Size Consideration

Sample size estimates were calculated in order to achieve the primary aim of the study, which was to examine the association between smoking status and social network characteristics among women residing in 3 rural Appalachian counties. The goal of recruitment was to enroll a total of 400 women across the 3 Appalachian counties. The sample size was justified based on the 2-level linear mixed model.³² The target sample size achieved a power of 0.84 (type I error = 0.05) for detecting a reduction of 1 in the average social network size between smokers and nonsmokers.¹

Recruitment

Recruitment followed a 2-phase address-based sampling approach. The intention of the first phase was to identify households with potentially eligible participants of the target subpopulation (ie, females, 18 years of age and older, residing in one of the targeted counties). A total of 1950 addresses were randomly selected from the original sampling frame and sent household enumerated questionnaire packets. This total came about using a repeated random sampling procedure per county, where 6 waves of 100 randomly selected addresses per county ($6 \times 100 \times 3 = 1800$) and 1 wave of 50 randomly selected addresses per county ($1 \times 50 \times 3 = 150$) were selected and sent questionnaire packets until the targeted response rate was acquired ($1800 + 150 = 1950$). Household enumerated questionnaire packets contained a cover letter explaining the study, an enumerated questionnaire to list all potentially eligible females in the household, if any, and a \$2 bill as an incentive. The cover letter made it clear that the study was being conducted specifically to examine women's health issues in the southern and eastern regions in Ohio, and that their help was an important first step to improving the health of women in [household specific] county. This was an effort to make a cultural connection with the population. The household enumerated questionnaire was modeled after Brick and associates'¹⁴ "Screen-Out" version, as it was found to produce the highest phase 1 response rate. Households were first asked to report if there were any females, 18 years of age and older, currently living in the household. If not, they were asked to check the "no" box and return the questionnaire in the provided postage-paid envelope. If "yes," respondents were asked to move on to step 2 of the questionnaire.

¹The power calculation follows the approximate formula of a 2-sided test at the top of page 3 in reference (31) directly. Since we are interested in a fixed effect of how smoking status, which is a level 1 variable, may affect the individual social network size, we chose to use the variance formula for scenario #2 (middle of page 4). Specifically, the total sample size is $m \times n = 400$. Based on previous knowledge, smoking prevalence is similar across the 3 counties, which is about 27%. We used this information to compute its variance as $0.27 \times 0.73 = 0.197$. To make sure we had enough power for this study, we chose the other 2 parameters conservatively:

1. The paper points out that the design effects is less than 1 for this scenario, which means our design is more efficient than the conventional design. We set design effects = 1 to be conservative and we didn't need information on level 2 residual variance.
2. The standard deviation of the level 1 residual was set to 3.5, which is also conservative since the outcome is the size of the individual social network, ranging from 0 to 9.

Here, it was asked that all females, 18 years of age or older currently living in the household, be listed by name. In addition, it was requested that a phone number be listed next to each name, in order for the woman to be contacted and invited to participate in the study. Finally, households were asked to return the enumerated questionnaire in the provided postage-paid envelope. All complete enumerated questionnaires were included in the numerator of the phase 1 response rate regardless if the household had any females, 18 years of age or older, presently living at the address.

In the cover letter, households were told that potentially eligible women would be contacted by research staff to confirm eligibility, determine interest in the study and to schedule a face-to-face interview about women's health behaviors that would last about 1 hour. The letter also disclosed that upon completion of the interview, women would receive a \$50 gift card as reimbursement for the time involved. For those not responding to the initial letter, follow-up materials were sent at 3 and 6 weeks. Those returning a questionnaire listing a woman's name with no contact phone number were sent a follow-up letter letting the woman know that she was potentially eligible for the study, and providing several ways that she could contact the study staff. For example, this letter provided the county interviewer's number, the project manager's email, and the general research project toll free telephone number. In addition, a special enclosure was created for this letter, allowing the woman to indicate whether she would like someone from the study to knock on her door, to email her at an address provided, or contact a third party at a phone number provided who could then get a message to her. Following Brick and associates'¹⁴ methodology, the \$2 incentive was only included with the first mailing. Recruitment began in August 2012 and concluded in October 2013. First-class mail was used for all mailings.

Phase 2 of the recruitment process was initiated when field interviewers contacted the women listed on the returned first-phase household enumerated questionnaire. Only 1 woman was selected per household. If more than 1 woman per household was listed on an enumerated questionnaire, research staff randomly selected who would be contacted. Interviewers attempted to call each selected woman 10 times (range = 1-10; M = 5.1.; SD = 2.4). Selected, eligible women interested in the study were invited by a field interviewer to participate in a one-time, in-person, 1-hour-long interview about her health and well-being, at a time and place convenient for the participant. Invitations were made by phone using the phone number provided on the returned phase 1 household enumerated questionnaires. Field interviewers resided in one of the counties used for recruitment, and they were each assigned to recruit and interview women from their county of residence. In this way, interviewers were able to personalize their interactions with the population of interest.

Findings

Response Rates

Phase 1—Following Brick,¹⁴ the response rates from phase 1 were calculated using the American Association for Public Opinion Research (AAPOR) Response Rate 1³³ with all undeliverable addresses treated as ineligible at phase 1. Figure 1 depicts a detailed description of the first phase response. Of the 1950 households that were sent a household enumerated questionnaire packet, 195 came back as undeliverable. As such, they were

excluded from the response rate calculation.³⁰ Others were returned as “refused,” (eg, a member of the household returned the questionnaire stating that they are not interested in participating), were returned with an incomplete enumerated questionnaire, or determined to be ineligible due to the household no longer living in Brown, Coshocton or Lawrence counties. Households no longer living in an eligible county were excluded from the response rate calculation.³¹ Finally, 926 questionnaire packets were never returned. This left a total of 776 household enumerated questionnaires that were completed and returned. As shown in Figure 1, the response rate for the first phase was 44.4%.

Phase 2—The second phase began with the 776 returned, completed household enumerated questionnaires. Of these, 599 reported that a woman 18 years of age or older lived in the household, while 177 questionnaires reported that no women resided in the household and were therefore counted as ineligible at phase 2. A total of 599 women were contacted by interviewers to be screened for eligibility and scheduled for an interview. Of these, 19 women were determined to be either no longer living in a participating county, or not yet to be 18 years of age. These women were excluded from the phase 2 response rate calculation due to ineligibility. In addition, interviewers were not able to make contact with a total of 55 women, while others refused to be interviewed once contact was made (n=116). A total of 408 women completed the in-person interview. Figure 2 provides a detailed description of the phase 2 response. Using the AAPOR RR 1 formula, the response rate for the second-phase interview was 70.3%.

Respondent Characteristics

Table 1 first presents the sociodemographic characteristics of the women in this study. Because of interest in determining the representativeness of our sample, we also included the characteristics of those of Ohio Appalachian females generally, as well as females in the 3 counties used for recruitment specifically. This information is based on the 2012 Ohio Medicaid Assessment Survey (OMAS),³⁴ a survey designed to produce reliable population estimates for regions in Ohio. OMAS is a geographically stratified telephone survey covering the state's non-institutionalized population. The 2012 OMAS has a sample size of 22,355 and the survey weights are post-stratified to population demographic data from the American Community Survey,³⁵ to ensure the representativeness. Since it is difficult to obtain the specific population level information for Ohio Appalachian women, we used 2012 OMAS data as a proxy. Sample participants were older, on average, than women generally in Ohio Appalachia. Women across all groups were mostly white. Sample women were more highly educated than the comparative groups, with more of them having at least a high school education. The number of women having never married was lower in the study sample than in Ohio Appalachia generally. Finally, Table 1 shows that both the level of poverty and smoking prevalence is lower among sample participants than typically found among females in Ohio Appalachia.

Given the particular interest with regard to tobacco use among this population, Table 2 shows the sociodemographic characteristics by smoking status for both samples of women, and women living in the 3 counties used for recruitment. Of the 408 women in the study sample, 20.1% were current smokers and 22.5% were former smokers. Using chi-square

tests for categorical variables and Kruskal-Wallis tests for continuous variables, significant differences in sociodemographic characteristics at the $P < .05$ were noted by smoking status among sample women. Current smokers were significantly younger, less educated, and more likely to have never been married as compared to never and former smokers. In addition, 36.5% of current smokers in the sample were members of households living at or below the poverty line, a proportion significantly higher than never and former smokers living in poverty.

Looking across groups, Table 2 shows that current smokers in our study and in OMAS 2012 data differed with regard to sociodemographic characteristics as compared to non-smokers (ie, former and never). In both samples, current smokers were younger in relation to non-smokers and less likely to be married. Current smokers in each group were also more likely to live in poverty as compared to non-smokers.

Discussion

This paper reports on the use of a 2-phase, mixed-mode, address-based sampling approach, using mail at phase 1 and in-person interviews at phase 2, and its effectiveness in recruiting a subpopulation of females in Ohio Appalachia into a research study. This study faced the potential challenges common to recruiting those living in Appalachian areas into cancer-related research: time demands hindering participation, lack of trust in those outside of one's culture or community, and logistical issues such as lack of transportation.^{3,4} These potential challenges had to be taken into consideration with the unique need of this study to obtain a representative sample, as well as to utilize an in-person survey approach. To aid in the recruitment of this population, we tailored recruitment letters to each recruitment county, used local field interviewers, and provided compensation.⁵⁻⁸ In addition, our study was connected to The Ohio State University, which has a good reputation in the state. We found respectable response rates at each phase of recruitment. Results of this study reported response rates similar to those found by Wagner and colleagues,²⁸ who recently examined the effect of mixed mode at the screening level on response rates to an in-depth interview. Our study confirms that using a mail screening process does not dampen in-depth interview response rates, and it is an effective method of recruitment.

It was also important in this study to see the effect of this 2-phase, mixed-mode approach on sample representativeness. We found our sample of Ohio Appalachian women to be more educated, affluent, and more likely to be employed compared to Ohio Appalachian females generally, and to females living in the counties represented in our sample. Females in this study were also less likely to be current smokers than other Ohio Appalachian females. The question as to why there was such a discrepancy in sample representativeness remains. In our study, women who were screened and deemed eligible for the study, but who refused to participate, were older and less educated than those in our sample (findings not reported). Interestingly, recent research found that a higher incentive level at the second phase attracted higher SES people in a national sample.¹⁵ Perhaps our second phase incentive boosted response rates, but it biased the sample toward those with more income and education. Future research may consider using a lower monetary incentive at this phase to see if the sample includes those lower in income and education.

Sample representativeness may have also been impacted by literacy. Brick and associates¹⁴ identified literacy as a challenge with any self-administered instrument, as wording must be made appropriate to a wide audience range. Literacy, on account of our mail-based recruitment letter, may have been a challenge in this study as well. Future research with this population should be careful to word recruitment letters at an appropriate reading level.

It is also possible that health literacy impacted the representativeness of our sample. Health literacy is defined as “the degree to which individuals have the capacity to obtain, communicate, process, and understand basic health information and services needed to make appropriate health decisions.”³⁶ Paashe-Orlow and colleagues’³⁷ systematic review of literature on health literacy showed that one-fourth of American adults had low health literacy and almost half had low or marginal literacy. Education and age were significantly associated with low literacy. Several studies have suggested that those with low health literacy may choose not to participate in research.^{38,39} In this study, given that households were made aware of the health nature of the in-person interview, it is possible that those lower in health literacy chose to not respond to the phase 1 household enumerated questionnaire. This may have had some impact on sample representativeness. Future research is needed to understand the role of health literacy in recruitment into health-related studies.

Finally, it may be that our sample differed from that of OMAS due to the commitment required to complete a 1-hour, in-person interview compared to that needed to complete a brief phone survey as required by OMAS. We find it important to note, however, that relatively speaking, patterns were similar between groups of smokers and nonsmokers across samples. Both in our sample and in population estimates from OMAS, smokers were more likely to have less education, less likely to be married, and more likely to live in poverty when compared to never and former smokers. A 2-phase address-based method may prove promising in the recruitment of women if the goal of the research is to compare current smokers with former and never smokers.

This study was not without limitations. First, the study specifically examined a 2-phase mixed-mode approach on a subpopulation of women in Ohio Appalachia. As such, it is difficult to generalize these findings. However, the results do allow insight into the process of this method of recruitment, and they add to recent literature regarding a 2-phase address-based approach. In addition, the sample size of the study was relatively small, and reliance was placed on OMAS data to be representative of women in the 3 selected counties while it is typically reported at the aggregate level. However, this did not prohibit differences to be found between sociodemographic characteristics by smoking status.

Despite its limitations, this study has added to the examination of the 2-phase, address-based approach for recruiting subpopulations by using a mixed-mode approach. Although the subpopulation studied here was limited to a particular region and gender, we obtained respectable responses at both the first and second phases and consider this an effective strategy to recruit from a hard-to-reach, underserved population group. Continued research in this area is warranted to further examine survey mode and incentives at each phase in both this and other subpopulations.

Acknowledgments

We would like to thank Michael Brick and Jill Montaquila, who provided us with sample letters that were modified for our study. In addition, we would like to thank Danqi Zhu for her assistance with data analysis.

Funding: This study was supported by a grant from the National Cancer Institute [P50 CA105632] and the Behavioral Measurement Shared Resource at The Ohio State University Comprehensive Cancer Center [P30CA016058].

References

1. Ford JG, Howerton MW, Lai GY, et al. Barriers to recruiting underrepresented populations to cancer clinical trials: A systematic review. *Cancer*. 2008; 112:228–242. [PubMed: 18008363]
2. Lai GY, Gary TL, Tilburt J, et al. Effectiveness of Strategies to Recruit Underrepresented Populations into Cancer Clinical Trials. *Clin Trials*. 2006; 3:133–141. [PubMed: 16773955]
3. Paskett ED, Reeves KW, McLaughlin JM, et al. Recruitment of Minority and Underserved Populations in the United States: The Centers for Population Health and Health Disparities Experience. *Contemp Clin Trials*. 2008; 29:847–861. [PubMed: 18721901]
4. Leach CR, Schoenberg NE, Hatcher J. Factors Associated with Participation in Cancer Prevention and Control Studies among Rural Appalachian Women. *Fam Community Health*. 2011; 34:119–125. [PubMed: 21378508]
5. Loftin WA, Barnett SK, Bunn PS, Sullivan P. Recruitment and Retention of Rural African Americans in Diabetes Research. *Diabetes Educ*. 2008; 31:251–259.
6. Parra-Medina D, D'Antonio A, Smith SM, Levin S, Kirkner G, Elizabeth Mayer-Davis E. Successful Recruitment and Retention Strategies for a Randomized Weight Management Trial for People with Diabetes Living in Rural, Medically Underserved Counties of South Carolina: The POWER study. *J Am Diet Assoc*. 2004; 104:70–75. [PubMed: 14702587]
7. Burns D, Soward ACM, Skelly AH, Leeman J, Carlson J. Effective Recruitment and Retention Strategies for Older Members of Rural Minorities. *Diabetes Educ*. 2008; 34:1045–1052. [PubMed: 19075086]
8. Rodriguez MD, Rodriguez J, Davis M. Recruitment of First-Generation Latinos in a Rural Community: The Essential Nature of Personal Contact. *Fam Process*. 2006; 45:87–100. [PubMed: 16615255]
9. Pollard, K., Jacobsen, LA. [Accessed December 8, 2016] The Appalachian Region: A data overview from the 2010-2014 American Community Survey. Appalachian Regional Commission. Available at: https://www.arc.gov/assets/research_reports/DataOverviewfrom2010to2014ACS.pdf
10. Appalachian Cancer Community Network. [Accessed June 26, 2015] Addressing the cancer burden in Appalachian communities. Available at: <http://www.accnweb.com/pages/cancer-burden-app.pdf>
11. American Cancer Society. [Accessed July 28, 2016] Cervical Cancer. Available at: <http://www.cancer.org/acs/groups/cid/documents/webcontent/003094-pdf.pdf>
12. Ohio Medicaid Assessment Survey. [Accessed December 8, 2016] Adult Dashboard. Available at: <http://grcapps.osu.edu/dashboards/OMAS/adult/>
13. Centers for Disease Control. [Accessed March 3, 2016] Tobacco control state highlights 2012. Available at: http://www.cdc.gov/tobacco/data_statistics/state_data/state_highlights/2012/states/ohio/index.htm
14. Brick JM, Williams D, Montaquila JM. Address-based sampling for subpopulation surveys. *Public Opin Q*. 2011; 75:409–428.
15. Han D, Montaquila JM, Brick MJ. An Evaluation of Incentive Experiments in a Two-Phase Address-Based Sample Mail Survey. *Proceedings of the American Statistical Association, Section on Survey Research Methods*. 2012:3765–3778.
16. Roth SB, Han D, Montaquila JM. The ABS Frame: Quality and Considerations. *Proceedings of the American Statistical Association, Section on Survey Research Methods*. 2012:3779–3793.
17. Brick MJ, Andrews WR, Mathiowetz NA. Single-phase mail survey design for rare population subgroups. *Field Methods*. 2016; :1–15. DOI: 10.1177/1525822X15616926

18. Montaquila JM, Brick JM, Williams D, Kim K, Han D. A Study of Two-phase Mail Survey Data Collection Methods. *J Surv Stat Methodol*. 2013; 1:66–87.
19. Burt RS. Network Items and the General Social Survey. *Soc Networks*. 1984; 6:293–339.
20. McPherson M, Smith-Lovin L, Brashears ME. Social Isolation in America: Changes in Core Discussion Networks over Two Decades. *Annu Rev Sociol*. 2006; 71:353–375.
21. Matzat U, Snijders C. Does the Online Collection of Ego-Centered Network Data Reduce Data Quality? An Experimental Comparison. *Soc Networks*. 2010; 32:105–111.
22. Carlson EB, Newman E, Daniels JW, Armstrong J, Roth D, Loewenstein R. Distress in Response to and Perceived Usefulness of Trauma Research Interviews. *J Trauma Dissociation*. 2003; 4:131–142. [Accessed August 8, 2016] Available at: http://dx.doi.org/10.1300/J229v04n02_08.
23. Johnson LE, Benight CC. Effects of Trauma-Focused Research on Recent Domestic Violence Survivors. *J Trauma Stress*. 2003; 16:567–571. [PubMed: 14690354]
24. Walker EA, Newman E, Koss M, Bernstein D. Does the Study of Victimization Revictimize the Victims? *Gen Hosp Psychiatry*. 1997; 19:403–410. [PubMed: 9438184]
25. Widom CS, Czaja SJ. Reactions to Research Participation in Vulnerable Subgroups. *Account Res*. 2005; 2005:115–138.
26. Amaya A, LeClere F, Carris K, Liao Y. Where to Start: An Evaluation of Primary Data-Collection Modes in an Address-Based Sampling Design. *Public Opin Q*. 2015; 79:420–442. [PubMed: 26120203]
27. Messer BL, Dillman DA. Surveying the General Public Over the Internet Using Address-Based Sampling and Mail Contact Procedures. *Public Opin Q*. 2011; 74:429–457.
28. Wagner J, Arrieta J, Guyer H, Ofstedal MB. Does Sequence Matter in Multimode Surveys: Results from an Experiment. *Field Methods*. 2014; 26:141–155. [PubMed: 24764767]
29. U.S. Census Bureau. [Accessed December 22, 2016] 2010. Available at: <https://www.census.gov/geo/reference/ua/urban-rural-2010.html>
30. Marketing Systems Group. [Accessed February 9, 2017] Research Developments in Address-Based Sampling (ABS). Available at: <http://www.m-s-g.com/CMS/ServerGallery/MSGWebNew/Documents/GENESYS/whitepapers/ABS-Brief.pdf>
31. Marketing Systems Group. [Accessed February 9, 2017] Genesys: Address Based Sample (ABS). Available at: <http://www.m-s-g.com/Web/genesys/Address-based-samples.aspx>
32. Snijders TAB. Power and Sample Size in Multilevel Linear Models. *Encyclopedia of Statistics in Behavioral Science*. 2005; 3:1570–1573.
33. American Association for Public Opinion Research. [Accessed December 11, 2016] Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. Available at: http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf
34. Ohio Medicaid Assessment Survey. [Accessed December 11, 2016] 2012. Available at: <http://grc.osu.edu/OMAS/2012Survey>
35. U.S. Census Bureau. [Accessed September 22, 2016] American Factfinder. 2012. Available at: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?_afPId=ACS_13_3YR_DP05&prodType=table
36. Institute of Medicine of the National Academies. Health literacy: A prescription to end confusion. Washington, DC: Institute of Medicine; 2004.
37. Paashe-Orlow MK, Parker RM, Gazmararian JA, Nielsen-Bohlman LT, Rudd RR. The Prevalence of Limited Health Literacy. *J Gen Intern Med*. 2005; 20:175–184. [PubMed: 15836552]
38. Artinian NT, Lange MP, Templin T, Stallwood LG, Christopher E, Hermann CE. Functional Health Literacy in an Urban Primary Care Clinic. *The Internet Journal of Advanced Nursing Practice*. 2003; 5(3):doi: 10.5580/deb
39. Baker DW, Parker RM, Williams MV, et al. The Health Care Experience of Patients with Low Health Literacy. *Arch Fam Med*. 1996; 5:329–334. [PubMed: 8640322]

Figure 1.
Recruitment Process and Response for Phase 1

Figure 2.
Recruitment Process and Response for Phase 2

Table 1
Sociodemographic Characteristics According to ABS^a Appalachian and OMAS^b 2012 Appalachian Data

	ABS Study, Females in 3 Ohio Appalachian counties (N=408)	2012 OMAS, Females in 32 Ohio Appalachian counties (N=3332)	2012 OMAS, Females in 3 Ohio Appalachian counties (N=232)
Age in years, mean $\pm$ SD (range)	51.7 $\pm$ 16.9 18.4-95.1	48.2 $\pm$ 24.2 *** 19.0-98.0	46.9 $\pm$ 23.3 ** 19.0-90.0
Race, white, <i>n</i> (%)	98.3	95.1 *	98.8
Education, (%)			
Less than high school (HS)	6.4	15.1 ***	20.6 ***
HS diploma or GED	27.9	38.3	36.0
>HS diploma	65.7	46.6	43.4
Marital Status (%)			
Never married	7.8	15.3 ***	14.9 *
Married/living with partner	71.6	57.5	59.3
Divorced/widowed/separated	20.6	26.8	25.8
Poverty to Income Ratio (%)			
<=100%	15.4	30.4 ***	40.0 ***
101-300%	41.2	39.9	36.1
>300%	43.4	29.7	23.9
Employment, fulltime/part-time (%)	48.0	45.2	35.6 *
Smoking Prevalence (%)	20.1	32.3 ***	31.8 *

^a Address-based sampling

^b Ohio Medicaid Assessment Survey (OMAS 2012)

* P < .05;

** P < .01;

*** P < .001 for tests comparing to ABS sample.

Sociodemographic Characteristics by Smoking Status of ABS^a Appalachian and OMAS^b 2012 Appalachian Data

Table 2

	Address-based Sampling (ABS)			2012 Ohio Medicaid Assessment Survey (OMAS)		
	Appalachian Current Smoker (N=82)	Appalachian Former Smoker (N=92)	Appalachian Never Smoker (N=234)	Appalachian Current Smoker (N=57)	Appalachian Former Smoker (N=57)	Appalachia Never Smoker (N=117)
Age in years, mean ± SD	44.8 ± 14.1	55.5 ± 15.2	52.6 ± 17.8	40.0 ± 22.3	56.0 ± 18.8	47.4 ± 20.7
Race, white (%)	97.6	98.9	98.3	99.3	99.0	98.5
Education (%)						
Less than high school (HS)	13.4	10.9	2.1	31.9	28.8	10.0
HS diploma or GED	28.1	31.5	26.5	34.3	32.6	39.1
>HS diploma	58.5	57.6	71.4	33.8	38.6	50.9
Marital Status (%)						
Never married	15.9	4.4	6.4	30.5	1.5	10.5
Married/living with partner	62.2	67.4	76.5	44.6	68.0	64.8
Divorced/widowed/separated	21.9	28.3	17.1	24.9	30.5	24.7
Poverty to Income Ratio (%)						
<100%	36.5	11.0	9.5	68.1	28.7	26.8
101-300%	41.9	48.8	37.8	23.9	43.5	41.5
>300%	21.6	40.2	52.7	8.1	27.8	31.7
Employment, fulltime/part-time (%)	48.8	47.8	47.9	32.1	28.6	41.3

^a Address-based sampling.

^b Ohio Medicaid Assessment Survey (OMAS 2012). Estimates for females in 3 selected counties.