Recruitment of a Geographically Representative Convenience Cohort at Community Colleges for Assessment of Environmental Exposures

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**Abstract**

Biomonitoring studies are generally undertaken to evaluate a target cohort representative of a narrow segment of the population known or suspected to have experienced a chemical exposure or evaluate a cohort representative of the general population to determine baseline exposures to a chemical or group of chemicals[[1]](#footnote-0). Establishing a cohort representative of a population requires extensive resources to select and recruit participants with demographics similar to the group of interest[[2]](#footnote-1); however, a carefully convenience cohort chosen may be sufficient to represent a population if the study parameters are narrowly defined or if enough samples are collected to ensure affected subpopulations are adequately represented within the study. This paper outlines the benefits of a novel approach to recruiting a convenience cohort representative of the population of interest through regional recruitment at community colleges.

**Key Words**

Convenience Cohort, Community College, Environmental Exposure

**Study Design**

Baseline environmental exposures to six metals (barium, beryllium, cadmium, lead, thallium, and uranium) and perchlorate are being determined throughout the Commonwealth of Virginia through biomonitoring. The hypothesis states that the exposure pathway for the previously listed metals and perchlorate is predominantly environmental and may vary by geographic region; however, exposure comparisons across demographic categories are made to explore other sources of exposure to these chemicals. Virginia is geographically diverse, spanning the Appalachian Mountains to the Atlantic Ocean. Within Virginia are small farming and mining communities, large cities and urban areas, military installations, and shoreline fishing and recreation areas; each with its unique environment and exposure risks for the chemicals of interest. Exposure was assessed by analysis of urine samples collected from participants recruited throughout the state.

Recruitment of a sufficient number of participants from each region may pose challenges for a small program and require an innovative approach. Approximately 385 participants are needed for each major demographic category for the data to be statistically significant relative to the population of Virginia at a 95% confidence level and a 5% confidence interval. Bulk mailings and phone banks are acceptable recruitment methods but are costly and time-consuming and require a significant effort to arrange sample collection.[[3]](#footnote-2) [[4]](#footnote-3) A cost-effective method to establish a geographically diverse cohort representing the Commonwealth of Virginia utilized in-person recruitment of convenience cohorts at institutions within the Virginia Community College System (VCCS). The VCCS consists of 23 community colleges serving geographically, socioeconomically, and recreationally diverse regions of the state where students, faculty, staff, and administrative personnel live and work, providing a pool of participants extending to all regions of Virginia.

The study population, while geographically diverse by design, may not favorably reflect all general population demographics such as age, gender, or race at the 95% confidence level and 5% confidence interval, however, potential limitations of a convenience cohort were considered against the convenience and cost of other sampling methods.

**Methods**

Researchers may choose to recruit human subjects at large colleges and universities in an effort to draw from a large, convenient, and cooperative population; however, it is difficult to obtain complete, representative geographical data from such a concentrated source. While sizable and willing populations are accessible on a university campus, their transient nature makes them unsuitable for geographical comparisons.

Community colleges are more suitable for study recruitment in geographically focused studies due to the representation of the populations they serve. Community colleges are commuter schools specifically located to serve the area population. The VCCS webpage states “If you are in Virginia, you are just 30 miles from a community college[[5]](#footnote-4).” Since students, faculty, and staff typically live and work within these regions; environmental exposures to chemicals are expected to be representative of the local population.

Each institution targeted for inclusion in this study was part of the VCCS; however, each college established its policies concerning research and permissible student interaction. Access to each campus to recruit participants was coordinated through the college’s Office of the Dean of Institutional Research and Effectiveness or other administrative office. Documents provided for consideration of this study included research summaries, informational pamphlets, surveys, and consent forms. Some colleges required a review of the study by an internal Institutional Review Board (IRB) others accepted the approval of the Virginia Department of Health IRB which reviewed and approved the study. Separate requests for access to each college demonstrated logistical issues due to the lack of a VCCS centralized IRB or other school-wide grant-approval authority.

With individual VCCS institutional IRB and Administrative approval, recruitment was conducted on-site at each campus by study personnel. All study personnel operated under the supervision of Principal Investigators who have completed the Collaborative Institutional Training Initiative program course on human subject research to ensure the study is conducted under the Common Rule and that PII (personally identifiable information) is protected. Pre-event advertising to enhance participation varied from site to site but included in-class announcements, social media, emails, and posters. Gift cards were offered as an incentive for participation. Subjects were provided an informational pamphlet, a consent form, and a survey used to gather basic demographic data. After the paperwork was completed, study personnel provided a collection kit to participants to self-collect a spot urine sample. A report explaining the significance of the data including the individual’s results compared to aggregated study and national data via the National Health and Nutrition Examination Survey (NHANES) [[6]](#footnote-5) is provided to participants if requested.

**Results and Discussion**

The primary goal of subject recruitment was to obtain a fair distribution of samples reflective of each region of Virginia; however, it was an accepted limitation of the study design that a confidence interval greater than 5% may result for some categories. Demographic results are presented (Table 1) as a representation of the study population recruited for the study to date (approximately 60% complete). No effort was or will be made to target any demographic group to enhance confidence levels or intervals. The cohort for this study will continue to be a convenience cohort. A sufficient number of samples has not been collected to justly compare exposures and evaluate trends for each region and demographic group at the target confidence level and interval; however, the collection of additional samples is expected to reach target levels. Study demographics were compared to the overall population of Virginia.

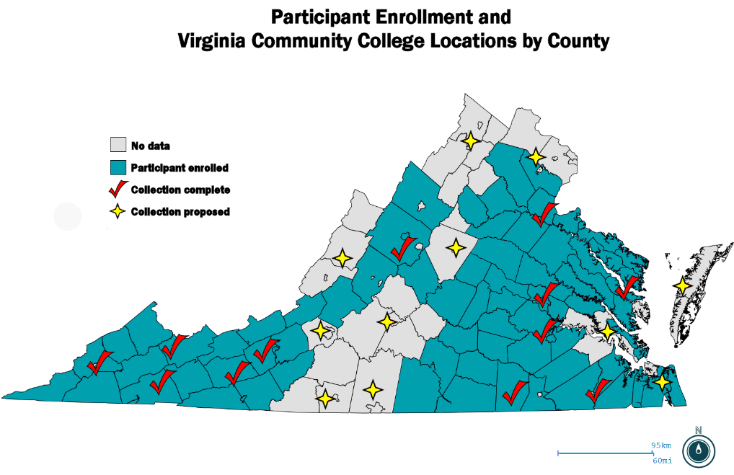
| **Study Enrollment and Virginia Population Comparison** | | |
| --- | --- | --- |
|  | Study Population  %  N=918 | Virginia  Population a  %  N=8,001,024 |
| *Age Group (years)* |  |  |
| 18-19 | 28.1 | N/A |
| 20-29 | 36.5 | 14.3 |
| 30-49 | 20.6 | 28.2 |
| 50+ | 14.8 | 31.8 |
|  |  |  |
| *Gender* |  |  |
| Female | 63.0 | 50.9 |
| Male | 35.6 | 49.1 |
| Other/declined | 1.4 | -- |
|  |  |  |
| *Race/Ethnicity* |  |  |
| Non-Hispanic white | 67.3 | 64.8 |
| Non-Hispanic black | 17.9 | 19.0 |
| All-Hispanic | 6.5 | 7.9 |
| Other/declined | 8.3 | 8.3 |
|  |  |  |
| *Smoking Status* b (self-report) |  |  |
| Non-Smoker | 79.7 | 83.5 |
| Smoker | 15.8 | 16.5 |
| Declined | 4.5 | --- |
| an Age and Gender Composition: 2010 (2010 Census Briefs) 18-19 Age group not available | | |
| b Virginia Current Smokers: 2015 Behavioral Risk Factor Surveillance System Prevalence and Trends Data | | |



The effort required to recruit subjects for a geographically-based study utilizing this method depends on the size of the area and the number of participants required to adequately represent the area. Responsiveness to requests and inquiries varied from college to college. Persistence and multiple attempts to establish a line of communication with the community college through phone or email were often required since most schools were unfamiliar with this type of study. The experience demonstrated that once contact was established and the review process commenced, colleges usually responded within two weeks but some extended for multiple months. To date, fifteen of twenty-three community colleges granted access to their campuses and one community college declined to participate. Efforts to establish contact with the remaining community colleges are ongoing.

Region

To date, samples have been collected at thirteen of the twenty-three community colleges throughout Virginia (Figure 1) from individuals residing in approximately 75% of Virginia counties. Remaining counties, particularly in the north and southcentral regions of the state, will be sampled through future collections. The total participants per region are presented in Table 2. The majority of participants recruited to date are from the central and southwest areas of the state. The eastern, northwestern, and northern regions will be the focus of future efforts.

**Figure 1**

| **Study Population by Region** | | |
| --- | --- | --- |
| Region | Participants | % of Total |
| Central | 381 | 41.5 |
| Eastern | 96 | 10.5 |
| Northwest | 145 | 15.8 |
| Southwest | 296 | 32.2 |
| Total | 918 | 100.0 |

**Table 2**

Age

Differences in the ages of participants in the study and the general population were known and accepted limitations of the study design. A chi-square analysis (χ2= 68 P<0.001 at ρ=0.05) of the age distribution shows no relationship to the age distribution of the Virginia population. The participation of faculty, staff, and administrative personnel resulted in better representation than was expected of the 30 – 49 and 50+ year-old age ranges within the study. The age distribution of additional participants from community colleges is not expected to differ significantly from the current study population.

Gender

The study population gender ratio is heavily weighted towards females compared to state demographics (χ2= 6.8 P = 0.009 at ρ=0.05). Anecdotal evidence suggests high participation among nursing students, the majority of which are female. This may account for a significant portion of the difference. The inclusion of incentives that are more appealing to males may be a viable way to recruit more male participants.

Race/Ethnicity

The racial and ethnic composition of the study population closely mimics statewide demographics (χ2= 0.69 P<0.875 at ρ=0.05). The cohort selected for this study is a convenience cohort; therefore, this result was completely serendipitous as no attempt was made to recruit subjects based on race, ethnicity, or any other demographic category.

Tobacco Use

Participants were requested to provide information concerning tobacco use on the study survey as tobacco use is known to correlate with high levels of urinary metals[[7]](#footnote-6). The study population, when normalized to remove those who declined to answer, exactly matches the Virginia population with regard to tobacco use.

**Conclusion**

Community college students, faculty, staff, and administrative personnel can be a suitable pool of subjects for geographically representative studies if demographic limitations are recognized and acceptable. The nature of many community college systems presents the opportunity to recruit a convenience cohort for representative geographic coverage that can be tailored to study a particular region or an entire state by the inclusion of institutions in the desired regions. The resulting study population may not reflect the demographics of the studied region; therefore, the researcher must determine if the introduced biases have a significant effect on the goals of the study. In the case of this study, we found a favorable correlation between the study participants and the Virginia population regarding race/ethnicity and smoking status and no correlation about age or gender.

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