

## LETTER TO THE EDITOR

### Optimizing Telephone-Based Population Sampling

To the Editor:

We read with interest Smith and colleagues' recent publication in *Annals of Epidemiology* (1). The authors observe few differences in estimates obtained from a directory-based telephone sample (DBS) and a random digit dialing (RDD) sample and argue that a continued reliance on RDD "seems unwarranted." Although we broadly agree with the authors' empiric observations that there are likely to be only small differences obtained from assessments of large RDD and DBS samples, we disagree with their conclusions on both conceptual and technical grounds.

The selection bias inherent in DBS limits the confidence researchers, and consumers of research, can have in population-based estimates obtained from DBS. Population-based sampling methods aim to sample persons in the general population and provide prevalence estimates of health and behavior. All sampling methods embed some degree of bias. RDD sampling, probably the most commonly used telephone-based method, is itself imperfect. The young, males, minorities, and the socioeconomically disadvantaged are generally underrepresented in most RDD surveys. The growing number of persons who are primary or exclusive cell-phone users tends to entrench these same biases. DBS surveys, by limiting the sample to the noninstitutionalized population with listed land lines (cell phones being generally unlisted), are yet another step in the same direction, exacerbating the same biases, and further undersampling groups with higher levels of mobility and with lower likely use of listed land lines. Unfortunately, this moves our samples further from the general population that is ultimately of interest. Also, there are additional systematic reasons why specific groups likely are underrepresented in listed samples. For example, doctors and police officers may not list a home telephone number, not wishing to be called by clients at home. Importantly, such differences, dependent as they are on cultural and local norms, probably vary between cities and countries making generalization across DBS samples difficult.

Smith and colleagues observe few statistically significant differences in the estimates obtained between listed and unlisted samples. This, however, is probably true for most studies with large samples barring egregious design flaws. We recently studied an RDD sample of residents of the New York City metropolitan area [described

elsewhere (2)]. Although the proportion of persons in this sample with listed telephone numbers was only 48%, we also found that, to use Smith and colleagues' formulation, "with a few exceptions," the estimates from the listed and unlisted sample were not substantially different (unpublished data). We differ, however, in the interpretation of these differences. Much of the value of population-based sampling rests on estimating, with as much precision as possible, the prevalence of certain conditions or behaviors. While at face value a 3% difference in the estimated proportion of persons who have had a certain number of sexual partners may not seem large, such differences amplify quickly when applied to predictive modeling (to which such an estimate, reflecting contact that may propagate infectious disease transmission, may well contribute), cost-benefit estimates, and health resource planning. Importantly, a 3% absolute difference based on a 26% prevalence represents a 10% misestimation of the prevalence of interest. These prevalence differences represent large numbers of persons in densely populated areas. For example, in New York City, there are approximately 6 million adult residents, and a 3% difference in disease or behavior prevalence represents 180,000 adults.

Finally, there are technical reasons why we would feel far less confident in results obtained from DBS versus RDD samples. In the United States, about 14% of the population moves each year, and among those who are 20–29 years of age, the rate is twice as high (3). Telephone companies tend not to reassign numbers for about a year to avoid caller overlap. A sample based on directories issued annually would therefore be missing approximately 15% of current residents and almost 30% of young adults just because the information is going out of date. This further reduces the likelihood that DBS samples will include the least settled portions of the population, persons who may well be at particular risk for specific risk behaviors of interest.

A critical function of our work is guiding public policy. As such, it is essential that we use methods that maximize the confidence in our findings and, as much as possible, minimize error. Absent such effort it will be tempting to accede to back-of-the-envelope public health planning with little basis on empiric fact. Given these limitations, it is unclear why researchers would consider using DBS instead of RDD. Smith and colleagues suggest that RDD is inefficient. However, there are probably better ways to cut costs that do

not obviate random sampling. We would suggest that use of smaller, more precise samples that as much as possible minimize systematic bias are preferable to larger samples embedding greater numbers of potential biases.

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## REFERENCES

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