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Collecting data on sensitive topics and on rare events through surveys

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How Many People Do You Know?: Efficiently Estimating Personal Network Size

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In this article we develop a method to estimate both individual social network size (i.e., degree) and the distribution of network sizes in a population by asking respondents how many people they know in specific subpopulations (e.g., people named Michael). Building on the scale-up method of Killworth et al. (1998b) and other previous attempts to estimate individual network size, we propose a latent non-random mixing model which resolves three known problems with previous approaches. As a byproduct, our method also provides estimates of the rate of social mixing between population groups. We demonstrate the model using a sample of 1,370 adults originally collected by McCarty et al. (2001). Based on insights developed during the statistical modeling, we conclude by offering practical guidelines for the design of future surveys to estimate social network size. Most importantly, we show that if the first names asked about are chosen properly, the estimates from the simple scale-up model enjoy the same bias-reduction as the estimates from our more complex latent nonrandom mixing model.

KEY WORDS: Latent nonrandom mixing model; Negative binomial distribution; Personal network size; Social networks; Survey design.

Scale-Up Methods as Applied to Estimates of Heroin Use

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The feasibility of using the network scale-up method to estimate heroin use is described. A random sample was asked "How many people do you personally know" who use heroin, and how many in other subpopulations – robbery, assault, burglary, auto-theft victims, binge drinkers, and marijuana users – whose size is more accurately known. A model estimated the overall number of persons each respondent knew and the size of each subpopulation. Estimates of the subpopulation are compared with known subpopulation sizes to assess the plausibility of the model. Data came from the 1999 survey evaluating the "Fighting Back" substance prevention program. Fourteen sites with clear political boundaries were used (n=5892). Heroin use varied from city to city. Rates estimated for heroin use correlated .832 with the level of respondents' sense of "crime in their neighborhood." The average ratio between the known populations and the estimates is .943. Members of each subpopulation, especially drug users, tended to know more people within their own subpopulation.

Counting hard-to-count populations: the network scale-up method for public health

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ABSTRACT

Estimating sizes of hidden or hard-to-reach populations is an important problem in public health. For example, estimates of the sizes of populations at highest risk for HIV and AIDS are needed for designing, evaluating and allocating funding for treatment and prevention programmes. A promising approach to size estimation, relatively new to public health, is the network scale-up method (NSUM), involving two steps: estimating the personal network size of the members of a random sample of a total population and, with this information, estimating the number of members of a hidden subpopulation of the total population. We describe the method, including two approaches to estimating personal network sizes (summation and known population). We discuss the strengths and weaknesses of each approach and provide examples of international applications of the NSUM in public health. We conclude samples of a population as well as a method to uniquely identify which individuals were recruited in more than one sample. Synthetic estimates and multivariate indicator methods are computationally intensive and may require data for each area in the country for which the estimate will apply.

A potential solution is a relatively new (to public health) technique for estimating the size of hidden or hard-to-reach populations: the network scale-up method (NSUM). We describe the background of the method, the results of its applications in public health, and an evaluation of its strengths and limitations. Finally, we report areas of further work in research and public health implementation for improving the method's utility for programming and planning, based on the consensus of an expert panel (see online supplementary appendix 1).

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Practice of Epidemiology

Assessing Network Scale-up Estimates for Groups Most at Risk of HIV/AIDS: Evidence From a Multiple-Method Study of Heavy Drug Users in Curitiba, Brazil

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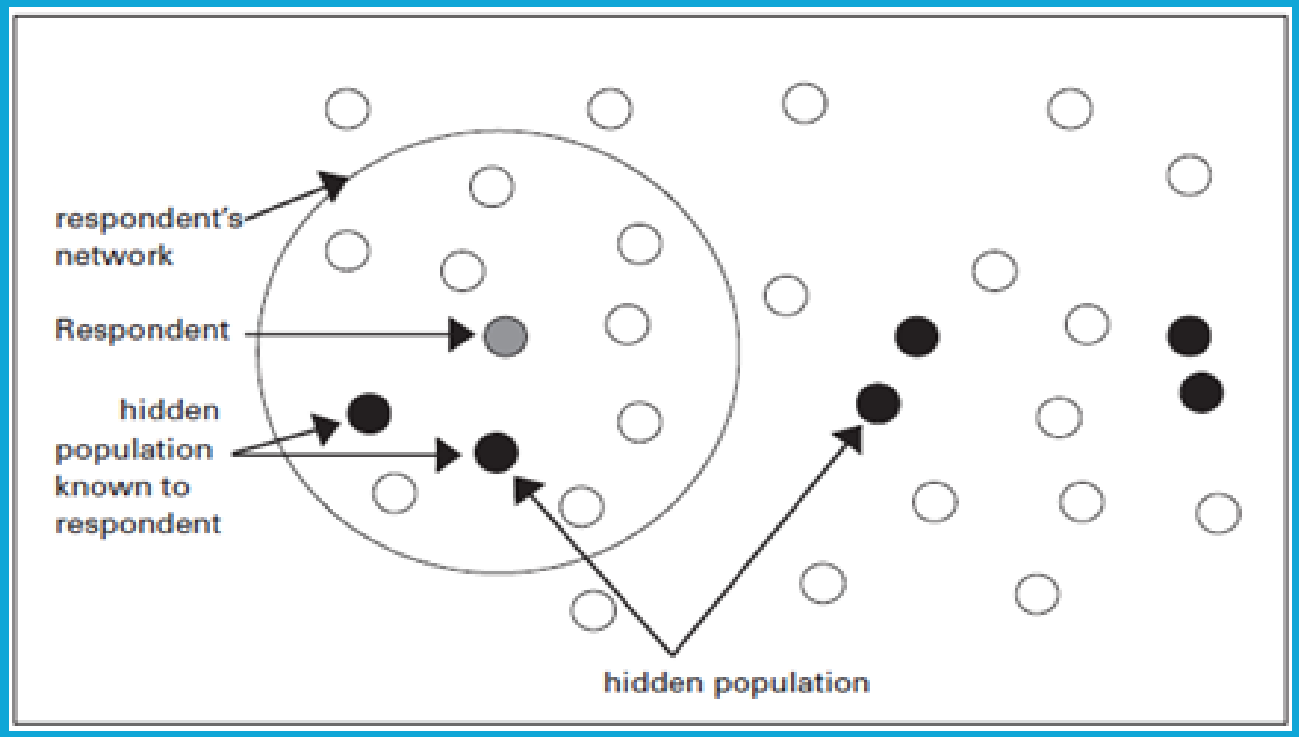
Network scale up

- People's social network … set of people they know … are on average representative of the general population



How does it work:

- In a random sample that is representative of the general population
  - How many people do you know?
  - How many people do you know who use drug x?

Estimated size of the sub population	=	Total # of members in the subpopulation from all participant networks / Total # of members from all participant networks	x	Size of the general population

Estimating personal network size

- How many people do you know…….
- Knowing some characterized by:
  - Live in the area of interest
  - You know them they know you
  - You have had contact with them over 1 or 2 years
  - You could contact them if needed

Two methods to estimate personal network

- Known population method
  - Number of people they know various population of known size (people named Michael; primary school teachers - 0.1% to 4 % of the population)
    - Knows 5 people named Michael,
    - 2 million people named Michael
    - Total population is 90 million
    - (5/2000000) ÷ 90 million total population = 225 size of the network
- Internal consistency checks with the existing data
- Can lead to under reporting in larger population and over reporting in smaller populations

Two methods to estimate personal network ….

- Summation method
  - No or unreliable data for known populations
  - Participants asked to enumerate people they know in a list of specific relationships or categories
  - exclusive relationship types (family, co-workers, neighbours, friends)
  - Comprehensive list of relationship type eliminating overlap
    - Culturally relevant
    - Limitation - lead to over counting from overlaps

Two main biases in network scale up

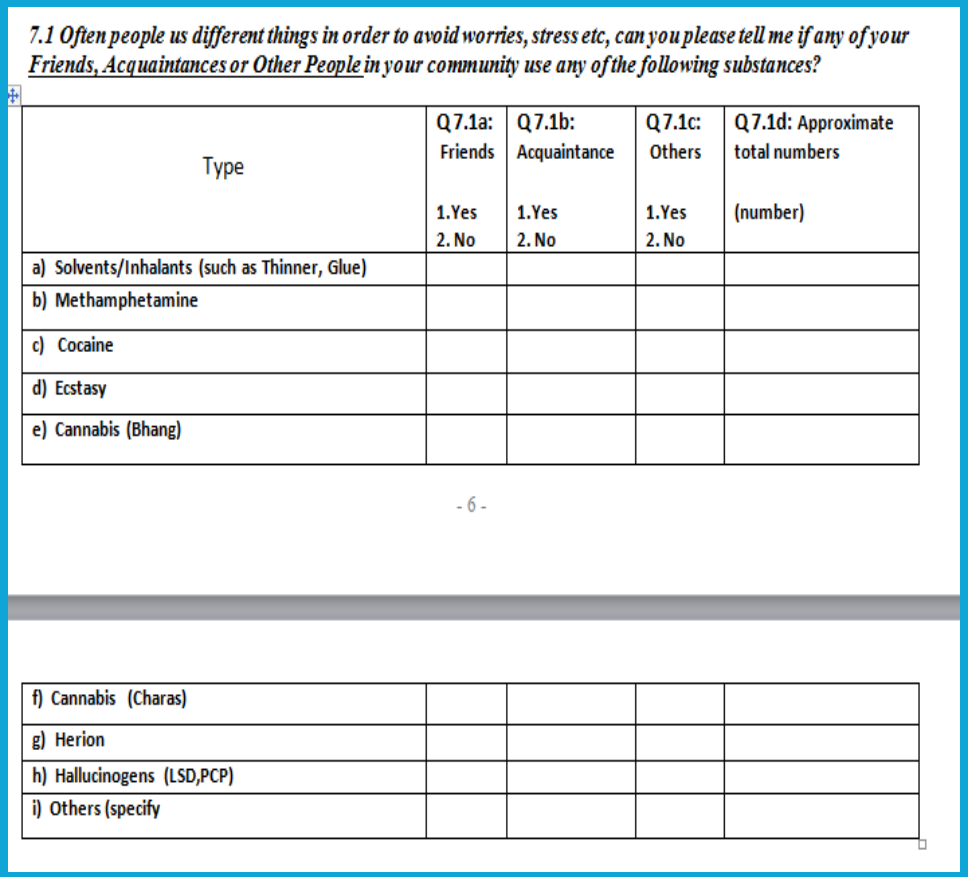
- Transmission error
  - Respondent is unaware of someone in network (is heroin user) – especially when behaviour is stigmatized – underestimation
- Barrier effect
  - Social barriers (ethnicity, race, occupation, location of residences) causes variation in likelihood a respondent will know the people with behaviour (underestimation)

Applying network scale up: UNODC experience

- Pakistan – national household survey on drug use (50,000 respondents)

- Self reported drug use in past 12 months
  - cannabis 0.5%
  - Heroin 0%
  - Non medical use of prescription opioids 1.4%

Pakistan…..



7.1 Often people us different things in order to avoid worries, stress etc, can you please tell me if any of your Friends, Acquaintances or Other People in your community use any of the following substances?

Type	Q7.1a: Friends 1.Yes 2. No	Q7.1b: Acquaintance 1.Yes 2. No	Q7.1c: Others 1.Yes 2. No	Q7.1d: Approximate total numbers (number)
a) Solvents/Inhalants (such as Thinner, Glue)				
b) Methamphetamine				
c) Cocaine				
d) Ecstasy				
e) Cannabis (Bhang)				

- 6 -

f) Cannabis (Charas)				
g) Herion				
h) Hallucinogens (LSD,PCP)				
i) Others (specify				

Using Dunbar number 150 as average size of network

Problem drug use survey(using treatment multiplier bench mark)

Combined to get

Prevalence of

- Cannabis 3.5%
- Heroin 0.8%

Nigeria – drug use survey

- Household survey Self reported use of substances (40,000 across 36 states and Federal Capital)
- NSUM - Known population method
- Problem drug use assessment (RDS – benchmark)
  (9,400 across 36 states and Federal Capital)

Comparison of results

Self reported

- Cannabis use 1.4%
- Heroin use – 0.03%
- Non medical use of opioids (tramadol) 3.8%

- **National estimate using NSUM, MBM**
- Cannabis use – 10.4%
- Heroin use – 0.1%
- Non medical use of opioids (tramadol) 4.8%