

Title: Stickiness of Respondent-Driven Sampling Recruitment Chains

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Can respondent-driven sampling (RDS) recruitment chains get stuck among socially stratified subgroups?

Respondent-driven sampling (RDS) is an increasingly popular chain-referral sampling method. Although it has proved effective at generating samples of hard to reach populations – meaning populations for which sampling frames are not available because they are hidden or socially stigmatized like sex workers or injecting drug users – quickly and cost-effectively, the ease of collecting the sample comes with a cost: bias or inefficiency in the estimates of population parameters (Gile & Handcock, 2010; Goel & Salganik, 2010). One way that RDS can produce inefficient estimates is if one or more of the recruitment chains gets stuck among members of a cohesive subpopulation, preventing the RDS sampling process from exploring other areas of the network. If that happens, members of the population subgroup recruit one another repeatedly, leading to an increase in sample size without increasing the diversity of the sample. This type of stickiness is particularly likely when hidden populations are stratified, and the stratified groups are organized into venues that provide opportunities to recruit other members of the same stratum. Female sex workers (FSW) in China, who are stratified into tiers of sex work that are correlated with marital status, age, and risk behaviors, are a prime example (Merli et al., 2014; Yamanis et al., 2013). Chinese FSW recruit clients from venues such as karaoke bars, massage parlors, or street corners. At larger venues, sex workers who participate in an RDS study might recruit other members of the same venue into the study at a higher rate than expected, leading to inefficient estimates. In short, the chain could get stuck in a venue.

[FIGURE ABOUT HERE]

To determine whether chains were getting stuck among members of stratified subpopulations, we created a recruitment chain diagram, which shows the pattern of recruitment in the RDS sample, using data from a study of 583 female sex workers recruited into an RDS

sample in Liuzhou, China. The data used for this diagram are described in Weir et al. (2012), who used them to compare estimates of characteristics of female sex workers recruited by two concurrent studies: an RDS study and a venue-based study. Vertices represent FSW who participated in the survey, and edges indicate that one FSW invited another to participate in the survey. The diagram starts at the top with the initial members of the sample, or seeds, and proceeds from top to bottom. Vertices are sized according to the size of the venue where the sex worker primarily solicited her clients. We assume that FSW in larger venues have more opportunity to recruit others from the same venue, and therefore we would expect that recruitment chains are more likely to get stuck in larger venues. Edges are colored according to whether both the recruiter and the recruit solicited clients from the same venue. Vertices are colored according to the tier of sex work. High tier venues include places like karaoke bars or dance halls, middle tier venues include places like massage parlors, and low tier venues include outdoor places like streets or parks. Non-venue based sex work means that sex workers solicit clients by telephone or text message.

Visual examination of the figure begins with consideration of the vertices. Through inspection of the vertices, two relationships become apparent. First, size of venue is related to venue tier. Almost all of the large venues employ sex workers classified as high tier; most middle and low tier venues are small, employing fewer than 20 people. Second, there is a significant amount of autocorrelation among the chains. Most of the high tier sex workers were recruited by other high tier sex workers, and two of the chains are almost entirely composed of FSW who solicit clients in large, high tier venues. Subsequent examination of the edges reveals that many of the recruitments between members of the high tier, large venue clusters of FSW are, in fact, from the same venue. In those cases – particularly in the 3rd chain and the 4th chain from

the left – the final members of the sample do not appear to be independent of the characteristics of the seeds, as early work on RDS would have suggested (Heckathorn, 1997, 2002). This illustration suggests that as new estimators for RDS (e.g., Gile, 2011) begin to account for more complicated dependencies in the recruitment chains, the estimators should incorporate information about where respondents meet others. Places like venues where sex workers operate can provide opportunities for sex workers with similar characteristics to interact, and therefore can provide opportunities for RDS chains to get stuck among subpopulations, leading to inefficient samples.

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Recruitment chains from a respondent-driven sample of female sex workers collected in Liuzhou, China

