Promises and Challenges of Using Respondent-Driven Sampling (RDS) Methodology for HIV Biological and Behavioral Surveillance in International Settings: A Systematic Review

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Introduction

- In concentrated and low-level epidemics the HIV epidemic is primarily driven by most-at-risk populations (MARPs).
- Accurate HIV epidemic data can inform policy-making but these data are often lacking among hard-to-reach groups such as injection drug users (IDUs), sex workers (SWs), and men who have sex with men (MSM) whose behaviors are stigmatized and illicit.
- Conventional probability-based sampling techniques are not applicable to certain MARPs due to inadequate sampling frame, and convenient sampling techniques (quota, snowball, targeted) do not generate representative samples.
- RDS can generate unbiased estimates of frequency variables if a sample if all of its methodological requirements are fulfilled.
- In recent years, RDS has been employed internationally to gather biological and behavioral risk data on HIV, yet misunderstandings about the method’s requirements exist and its use has been questioned.

Objectives

- To explore the effectiveness of RDS in recruitment of certain MARPs in different socio-cultural settings outside of North America.
- To summarize operational and analytical characteristics of RDS methods used to conduct biological and/or behavioral HIV surveillance surveys internationally.

Method

Search strategies: We conducted a comprehensive search to find studies that used RDS methods to conduct biological and/or behavioral HIV surveillance surveys internationally, including: (1) database search using relevant keywords in MEDLINE, Google Scholar, and Web of Science; (2) first-hand data provided by co-authors; (3) contacting key researchers or relevant international organizations with history of using RDS; (4) hand search of citations of peer-reviewed journals.

Eligibility criteria: (1) published and unpublished manuscripts, abstracts, reports, protocols and notes from field supervisors; (2) available by October 2007; (3) conducted in countries other than the U.S.: (4) HIV/HCV/STI biological and/or behavioral surveillance surveys using RDS; (5) met certain RDS methodology requirements.

We included studies if they: (a) initiated recruitment chains with seeds; and (b) used a recruitment quota; and (c) collected social network size data; and (d) recorded who recruited whom, and (e) had one or more seeds that could generate a minimum of three referral waves. We excluded studies if they: (a) did not generate weighted estimates of variable frequency and confidence intervals or; (b) combined an RDS sample with other samples; or (c) combined samples from multiple RDS studies.

Data Extraction/ Analysis: Two reviewers coded articles using a detailed coding Excel sheet for further analysis. We defined outcome of interest as the ratio between recruited and calculated sample sizes. We used students’ t-tests and Poisson multivariate regression analyses to examine explanatory factors for poor study outcomes.

Results

Total identified studies: 155
Included studies: 123 (79%); Excluded studies: 32 (21%)

Reason for exclusion:
- combined RDS samples with other sampling techniques: 19 (59%)
- failed to generate a minimum of three referral waves: 5 (16%)
- data on size of social networks was inconsistently/not reported: 4 (13%)
- did not analyze the data using proper RDS techniques: 2 (6%)
- did not provide sufficient information about RDS recruitment requirements: 1 (3%)
- combined samples from two different RDS studies: 1 (3%)

Conclusion

- RDS has been used widely for HIV prevalence and risk behavior surveillance in MARPs.
- If designed and conducted correctly, RDS is a useful and effective sampling tool to study MARPs and to better understand epidemic dynamics. It has been relatively more successful in IDUs in terms of recruitment efficiency.
- There has been heterogeneity in implementation and reporting of RDS studies. It would be useful to establish certain key data that should be reported for each study. Careful assessment of proper incentive is crucial to avoid several operational challenges.
- RDS does not necessarily work in all MARPs:
  - It does not work if the population is not networked.
  - It does not work if individuals are unwilling to refer their peers.

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Table 1. Predictors of the Sample Size Ratio in Multivariate Analysis (Number of studies = 84)

<table>
<thead>
<tr>
<th>Variable</th>
<th>IRR (95% CI)*</th>
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<tbody>
<tr>
<td>IDU group (vs. other groups)</td>
<td>1.11 (0.99-1.24)</td>
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<tr>
<td>Considering design effect (&gt;1.5)</td>
<td>1.10 (0.93-1.31)</td>
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<tr>
<td>Using more than one recruitment site</td>
<td>1.02 (0.90-1.22)</td>
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<tr>
<td>Using coupon expiration date</td>
<td>0.88 (0.78-0.99)</td>
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* Adjusted incidence rate ratio (IRR) based on multivariate Poisson regression model with 95% confidence interval through robust procedure. P-value of coefficient < 0.05