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Publisher: Routledge

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AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/caic20>

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Published online: 07 Oct 2009.

To cite this article: Lisa Grazina Johnston, Aire Trummal, Liilia L[otilde]hmus & Ardi Ravalepik (2009) Efficacy of convenience sampling through the internet versus respondent driven sampling among males who have sex with males in Tallinn and Harju County, Estonia: challenges reaching a hidden population, *AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV*, 21:9, 1195-1202, DOI: [10.1080/09540120902729973](https://doi.org/10.1080/09540120902729973)

To link to this article: <http://dx.doi.org/10.1080/09540120902729973>

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Efficacy of convenience sampling through the internet versus respondent driven sampling among males who have sex with males in Tallinn and Harju County, Estonia: challenges reaching a hidden population

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(Received 7 June 2008; final version received 7 January 2009)

This paper examines challenges obtaining representative samples of males who have sex with males (MSM) in Estonia and provides descriptive HIV behavioral data gathered from four cross-sectional surveys; three using the internet, and one using respondent driven sampling (RDS) to recruit MSM in Tallinn and Harju County. Estonian MSM were sampled between March and May in 2004 ($n = 193$), August and November in 2005 ($n = 146$) and September and December in 2007 ($n = 238$) using internet websites. MSM in Tallinn and Harju County were sampled between April and June in 2007 ($n = 59$) using RDS. Recruitment of MSM using RDS did not acquire the calculated sample size. The RDS study reached a less diverse group of MSM than did the internet studies which recruited a larger proportion of MSM who were older, bisexual, having female sexual partners during the last six months, and unlikely to have been tested for HIV. The findings and observations presented in this paper could inform researchers in Estonia, and the region, about the efficacy of and socio-cultural challenges to sampling MSM to collect HIV biological and/or behavioral data.

Keywords: males who have sex with males; respondent driven sampling; internet sampling; HIV; Estonia

Introduction and background

Estonia has an HIV prevalence greater than the majority of neighboring countries (European Centre, 2007) and predominately driven by injecting drug use (Morozova, Riekstina, Sture, Wells, & Leimane, 2003; Partnership to Fight HIV/AIDS, 2004; Platt et al., 2006a; Uusküla et al., 2005). Other HIV high-risk groups in Estonia and the region include the partners of injecting drug users (IDUs) and sex workers (SWs) (Hamers & Downs, 2003; Trummal, Fischer, & Raudne, 2006). Little is known about the roles of males who have sex with males (MSM) in Estonia – a group often classified, along with IDUs and SWs, as being at high risk for HIV. About 5–10% of HIV infections worldwide are estimated to occur through sex between men (UNAIDS, 2006).

Since 2004, Estonian researchers have used the internet as a method for gathering HIV behavioral risk data from MSM. Internet sampling has several advantages, including a greater level of anonymity, faster recruitment, lower cost, and the possibility for more technologically advanced data collection (Chiasson et al., 2006; Pequegnat et al., 2007; Zhang, Bi, Hiller, & Lv, 2008) as well as the potential to capture more hidden types of MSM; those who may

be more “closeted” and less likely to self-identify as MSM (Elford, Bolding, Davis, Sherr, & Hart, 2004; Ross, Tikkanen, & Mansson, 2000; Rosser et al., 2005) compared to other types of sampling methods. Internet sampling is subject to numerous biases (e.g., selection bias, misrepresentation as a member of the sampled population, repeat participation, missing data, inability to gather biological specimens, etc.) and is not representative of the wider MSM population (Pequegnat et al., 2007).

Recently, Estonian researchers have applied respondent driven sampling (RDS) to gather HIV prevalence and risk behaviors from hard-to-reach groups, including MSM (Platt et al., 2006a; Uusküla et al., 2005, 2008). RDS has been used successfully in dozens of studies around the world as a relatively easy to implement and effective sampling method to gather representative data from MSM (Johnston et al., 2008; Malekinejad et al., 2008; Ramirez-Valles, Heckathorn, Vasquez, Diaz, & Campbell, 2005). RDS uses chain referral sampling along with measurements of each participant’s peer group (degree) and recruitment patterns (the characteristics of who recruited whom) to derive adjusted proportions and variance estimates (Heckathorn, 1997, 2002). RDS can generate estimates that are representative of the

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population from which the sample was gathered (Salganik & Heckathorn, 2004).

Tallinn, Estonia's capital and largest city (population 396,852), comprises 30% of the Estonian population (Statistics Estonia, 2007) and approximately 41% of the new HIV cases registered between 2002 and 2006 (West-Tallinn Central Hospital, 2007). Harju County surrounds Tallinn. Rough estimations place the number of MSM in Estonia at just under 20,000, most of whom live in Tallinn and Harju (T–H) County (Representative from Diversity LGBT, Tallinn).

This paper examines challenges obtaining samples of MSM in Estonia and provides descriptive HIV behavioral data gathered from four cross-sectional surveys; three using the internet and one using RDS to recruit MSM in T–H County. The findings and observations presented in this paper could inform researchers in Estonia, and the region, about the efficacy of and socio-cultural challenges to sampling MSM to collect HIV biological and/or behavioral data.

Methods

Estonian MSM were sampled between March and May, 2004, August and November in 2005 and September and December in 2007 using internet websites. MSM in T–H County were sampled between April and June, 2007, using RDS.

Internet survey

The internet surveys were posted on Estonian and Russian language Gay-related websites for periods long enough to complete at least 300 questionnaires. Participants who entered the website main page and clicked the link to “respond to a few questions” were informed about the nature of the questionnaire, how to complete it, eligibility, and that it was anonymous. Upon completing the questionnaire, participants clicked a button to download it to a coded database.

Eligible participants were meant to be male and living in Estonia. No personal identifiers were gathered. Only those participants reporting being from T–H County are included in the analysis presented here.

Respondent driven sampling (RDS) survey

During the RDS planning phase, six in-depth interviews, each lasting from 45 to 80 minutes, were conducted with MSM found through the Estonian Gay League to assess the probability of success and acceptability of RDS among MSM. Questions centered on MSMs' degree, preferred survey logistics

(hours and days, interview location), and their willingness to invite peers to the survey.

The RDS survey was conducted at a fixed location in the center of Tallinn city. Eleven non-randomly selected MSM seeds with diverse characteristics (ages between 22 and 37; Russian and Estonian; differences in employment and education level) were selected to initiate recruitment. Each seed was asked to recruit three other MSM. Eligible participants were male, had sex (anal or oral) with another man in the past six months, 18 years or older, and living in T–H County. After eligible and consenting men responded to self-administered questionnaires in Estonian or Russian, they received pre-test counseling and were asked to provide seven MLs of venous blood which was screened for HIV, syphilis, and hepatitis B. Participants who elected to receive their test results returned to the survey location two weeks after blood collection. All information gathered during the survey process was anonymous and linked by a unique identification number.

Those who enrolled in the survey received a gift certificate (primary incentive) worth 100 Kroons (~8.3 USD) valid at a large shopping center. Midway through the survey this incentive was doubled in an effort to stimulate recruitment. Those who recruited their peers received up to three gift certificates (secondary incentive) each worth 100 Kroons.

Recruitment was planned to continue until the calculated sample size of 400 was reached or for a maximum of 12 weeks. Upon returning to the interview location for test results and/or secondary incentives, participants were asked about the peers who refused to accept coupons. In addition, seeds were asked to contact their peers who accepted a coupon, but did not enroll in the survey, to ask them why they chose not to participate.

Analysis

Estimates and 95% confidence intervals (CI) of the RDS data were calculated using the RDS Analysis Tool (RDSAT) V.5.6 (www.respondentdrivensampling.org). Estimates and variance are calculated by weighting participants' degree (Salganik & Heckathorn, 2004). Degree was measured by asking “how many men do you know, they know you, they have had sex with another man in the past 6 months, they are 18 years and older, they live in T–H County and you have seen them in the past four weeks?”

Chi-square (χ^2) tests were used to compare differences between the three internet studies (only those studies for which the question was asked are reported) and between the internet studies and RDS

study. Significance was set at $p \leq 0.05$ and non-significant findings are reported as N/S.

Findings

Tables 1–3 provide findings from the internet and RDS studies presented below.

Internet surveys

The final sample sizes for the internet surveys comprising respondents from only T–H County were 193 for 2004, 146 for 2005, and 238 for 2007.

More than half of respondents were between the ages of 20 and 39 and greater than 40% had educational backgrounds beyond secondary school (N/S). Although, the majority of respondents reported having Estonian ethnicity, there were significantly fewer Estonians and more Russians in 2005 than in 2004 and 2007 ($\chi^2 = 21.9$, $p = 0.001$). In 2004, there were significantly fewer self-defined homosexuals and more bisexuals than in the later studies ($\chi^2 = 38.1$, $p = 0.001$) although, most men reported themselves as homosexual. In 2004, 0.5% of MSM reported injecting drugs and 11.4% had used non-injecting drugs during the last six months.

In 2005 and 2007 just over half of men (53.4 and 58.8%, respectively) responded correctly to knowledge about HIV transmission (N/S). In 2004, 69.9% and 2005, 79.5% of men had no misperceptions about

HIV and in 2004, 66.3% and 2005, 71.9% were tolerant of people living with HIV and AIDS (PLWHA) (N/S). The percentage of men having had an HIV test in the past year rose slightly but insignificantly from 2004 (26.1%) to 2005 (30.4%) and 2007 (34.5%)

In 2007 a significantly higher percentage of men reported having two or more male oral or anal sex partners (67.2%; $\chi^2 = 14.4$, $p = 0.01$) in the previous six months compared to 2005 (56.0%) and 2004 (54.4%). Less than half of men reported having two or more male anal sex partners in the previous six months (35.2% in 2004; 41.3% in 2005; 44.1% in 2007 – N/S). Few men reported having female sex partners over the past six months (21.6% in 2005; 16.7% in 2007 – N/S). There was a slight but insignificant increase in the percentage of respondents reporting using condoms every time during anal intercourse with a casual male partner during the previous six months from 2005 (54.8%) to 2007 (57.7%). Among those men who reported having sex with a female casual partner in the previous six months, 53.1% in 2007 to 46.9% in 2007 reported using condoms every time (N/S).

Respondent driven sampling (RDS) findings

Based on the pre-survey responses from in-depth interviews with MSM, interest in the planned RDS survey was relatively high. However, several

Table 1. Background characteristics from three internet surveys (2004, 2005, and 2007) and one survey using respondent driven sampling (2007) among MSM in Tallinn and Harju County, Estonia.

| Variable | Internet study 2004 | | Internet study 2005 | | Internet study 2007 | | RDS study | | |
|-----------------------------|---------------------|------|---------------------|------|---------------------|------|-----------|------|------------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | 95% CI |
| Sample (<i>N</i>) | 193 | | 146 | | 238 | | 59 | | |
| Age | 192 | | 144 | | 238 | | 59 | | |
| ≤19 | 35 | 18.2 | 30 | 20.8 | 37 | 15.6 | 3 | 11.9 | 0.0, 24.2 |
| 20–29 | 88 | 45.9 | 71 | 49.3 | 105 | 44.1 | 37 | 54.2 | 37.9, 79.4 |
| 30–39 | 44 | 22.9 | 29 | 20.1 | 60 | 25.2 | 18 | 32.6 | 8.6, 53.2 |
| >40 | 25 | 13.0 | 14 | 9.7 | 36 | 15.1 | 1 | 1.3 | 0.0, 2.8 |
| Nationality | 193 | | 146 | | 237 | | 59 | | |
| Estonian | 144 | 74.6 | 82 | 56.2 | 184 | 77.6 | 41 | 53.1 | 22.0, 83.7 |
| Russian and other | 49 | 25.4 | 64 | 43.8 | 53 | 22.4 | 18 | 46.9 | 16.3, 78.1 |
| Education | 188 | | 145 | | 238 | | 59 | | |
| Primary school or less | 23 | 12.2 | 19 | 13.1 | 24 | 10.1 | 2 | 7.4 | 0.0, 19.9 |
| Secondary vocational school | 87 | 46.3 | 63 | 43.4 | 114 | 47.9 | 25 | 38.6 | 21.7, 56.2 |
| Higher | 78 | 41.5 | 63 | 43.5 | 100 | 42.0 | 32 | 54 | 32.3, 75.4 |
| Sexual orientation | 191 | | 146 | | 238 | | 59 | | |
| Homo-sexual | 113 | 59.2 | 100 | 68.5 | 169 | 71.0 | 49 | 79.1 | 59.8, 94.3 |
| bi-sexual | 78 | 40.8 | 33 | 22.6 | 54 | 22.7 | 6 | 9 | 2.5, 17.5 |
| Not defined | – | – | 7 | 4.8 | 13 | 5.5 | 4 | 11.9 | 0.3, 28.8 |
| Other | – | – | 6 | 4.1 | 2 | 0.8 | 0 | 0 | |

Table 2. HIV knowledge, misperceptions, attitudes, and testing from three internet surveys (2004, 2005, and 2007) and one survey using respondent driven sampling (2007) among MSM in Tallinn and Harju County, Estonia.

| Variable | Internet study 2004 | | Internet study 2005 | | Internet study 2007 | | RDS study 2007 | | |
|--------------------------------|------------------------|------|------------------------|------|------------------------|------|----------------|------|-----------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | 95% CI |
| Sample (<i>N</i>) | 193 | | 146 | | 238 | | 59 | | |
| Knowledge ^a | – | – | 146 | | 238 | | 59 | | |
| Right knowledge | – | – | 78 | 53.4 | 140 | 58.8 | 33 | 36.5 | 17.3–51.8 |
| Wrong knowledge | – | – | 68 | 46.6 | 98 | 41.2 | 26 | 63.5 | 48.3–82.7 |
| Misperceptions ^b | 193 | | 146 | | – | – | 59 | | |
| No misperceptions | 135 | 69.9 | 116 | 79.5 | – | – | 47 | 76.6 | 54.3–92.7 |
| Misperceptions | 58 | 30.1 | 30 | 20.5 | – | – | 12 | 23.4 | 7.4–45.7 |
| Attitudes – PLWHA ^c | 193 | | 146 | | – | – | 59 | | |
| Positive attitudes | 128 | 66.3 | 105 | 71.9 | – | – | 53 | 87.8 | 75.0–95.8 |
| Negative attitudes | 65 | 33.7 | 41 | 28.1 | – | – | 6 | 12.2 | 4.2–35.0 |
| Last HIV test | 188 | | 145 | | 238 | | 59 | | |
| During last year | 49 | 26.1 | 44 | 30.4 | 82 | 34.5 | 20 | 36.2 | 20.6–55.2 |
| More than a year ago | 34 | 18.1 | 25 | 17.2 | 46 | 19.3 | 22 | 28.5 | 13.6–43.2 |
| Never tested | 105 | 55.8 | 76 | 52.4 | 110 | 46.2 | 17 | 35.3 | 17.2–55.8 |

^aHIV knowledge was measured by answering “yes” to “the risk of HIV transmission can be reduced by using a condom during every sexual intercourse,” “a healthy-looking person can have HIV,” “a person can get HIV if he injects with a syringe that was previously used by someone else,” and “the risk of HIV transmission can be reduced by having sex with only one uninfected partner who is faithful to you”; and by answering “no” to “a person can get HIV from a mosquito bite.”

^bHIV transmission misperceptions were measured by answering “yes” to it being possible to get HIV by “hugging an HIV infected person,” “eating from the same dishes as an HIV infected person,” and “using the same toilet as an HIV infected person.”

^cPositive attitudes toward people living with an HIV and AIDS (PLWHA) were measured by responding “no” to, “I would stop communing with any acquaintance if he were infected with an HIV”; and “yes” to “I would agree to work in the same office with an HIV infected person.”

potential obstacles were mentioned including MSM might be fearful of meeting someone they knew at the interview location, would not have time or motivation to participate, would not want to receive HIV testing and results during a survey, especially if they have not received testing in the past, and that the incentive was too low to encourage male SWs to participate.

When MSM were contacted to become seeds, two refused, one stating that he did not want to give blood, and the other stating that his MSM friends and acquaintances were family men with good jobs and reputations and “who do not want this kind of attention.” Two other seeds who originally agreed to participate never showed up at the interview site despite numerous attempts to contact them.

Over the course of 12 weeks, 59 MSM were interviewed. In addition to doubling the primary incentive gift card amount midway through the study, ads were put on four gay websites, one forum and three MSM mailing lists as efforts to increase participation. Unfortunately, these methods did not improve recruitment.

Most MSM ($n = 43$, 73% of the sample) returned for test results and responded to questions about the reasons their peers would not accept a recruitment coupon. These participants managed to distribute 83 coupons and had 60 refusals to accept a coupon. Participants who had peers refuse to accept a coupon reported the following reasons: peers were too busy ($n = 17$, 28.3%), not interested ($n = 15$, 25%), afraid of being identified as MSM ($n = 7$, 11.7%), and not willing to give blood ($n = 6$, 10%).

Among those who enrolled in the RDS study, most were aged 20–29 years old (54.2%), Estonian (53.1%), had higher education (54.0%), and self-identified as homosexual (79.1%) rather than bisexual (9.0%) or not self-identified (11.9%). No MSM reported injecting drugs and only two (1.5%) reported using non-injecting drugs during the last four weeks.

The majority of respondents had incorrect HIV transmission knowledge (63.5%), mostly due to responses that mosquitoes could transmit HIV. The majority of MSM had correct perceptions (76.6%) about HIV and were tolerant of PLWHA (87.8%). Most respondents stated having two or more male

Table 3. Sexual risk behaviors from three internet surveys (2004, 2005, and 2007) and one survey using respondent driven sampling (2007) among MSM in Tallinn and Harju County, Estonia.

| Variable | Internet study 2004 | | Internet study 2005 | | Internet study 2007 | | RDS study 2007 | | |
|---|---------------------|------|---------------------|------|---------------------|------|----------------|------|-----------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | 95% CI |
| Sample (<i>N</i>) | 193 | | 146 | | 238 | | 59 | | |
| Sexual partners | | | | | | | | | |
| How many different <i>male partners (oral and anal sex partners)</i> have you had during the past six months? | | | | | | | | | |
| None ^a | 37 | 19.2 | 24 | 17.0 | 19 | 8.0 | 0 | 0 | 1 |
| One partner | 51 | 26.4 | 38 | 27.0 | 59 | 24.8 | 15 | 34.8 | 11.4–61.8 |
| ≥2 partners | 105 | 54.4 | 79 | 56.0 | 160 | 67.2 | 43 | 65.2 | 38.2–88.6 |
| How many different <i>male anal sex partners</i> have you had during the past six months? | | | | | | | | | |
| None ^a | 67 | 34.7 | 38 | 27.5 | 53 | 24.1 | 2 | 0 | 1 |
| One partner | 58 | 30.1 | 43 | 31.2 | 70 | 31.8 | 31 | 64.6 | 40.1–91.1 |
| ≥2 partners | 68 | 35.2 | 57 | 41.3 | 97 | 44.1 | 25 | 35.4 | 8.9–59.9 |
| How many different <i>female partners</i> have you had during the past six months? | | | | | | | | | |
| None | – | – | 139 | 78.4 | 190 | 83.3 | 53 | 100 | 4 |
| One partner | – | – | 17 | 12.2 | 20 | 8.8 | 2 | 0 | |
| ≥2 partners | – | – | 13 | 9.4 | 18 | 7.9 | 0 | 0 | |
| Condom use | | | | | | | | | |
| In the past six months, how often was condom used during <i>anal intercourse with male casual partner</i> ? | | | | | | | | | |
| Every time | – | – | 40 | 54.8 | 75 | 57.7 | 26 | 42.3 | 23 |
| Not every time | – | – | 33 | 45.2 | 55 | 42.3 | 10 | 57.7 | 7.5–78.0 |
| In the past six months, how often was condom used during <i>intercourse with female casual partner</i> ? | | | | | | | | | |
| Every time | – | – | 8 | 34.8 | 15 | 46.9 | – | – | 57 |
| Not every time | – | – | 15 | 65.2 | 17 | 53.1 | – | – | – |

^aIn 2004 study it is not possible to separate those who had no partners and who did not answer this question.

oral and anal sex partners (65.2%) and only one male anal sex partner (64.6%) in the previous six months. Only two respondents reported having a female sexual partner in the previous six months and 42.3% reported using condoms every time during anal intercourse with a casual male partner in the previous six months.

Just over a third of men reported having had an HIV test in the past year (36.2%) and never having had an HIV test (35.3%). No MSM tested positive for syphilis or hepatitis B and one was HIV-positive (5.0%). The respondent who tested HIV-positive was aware of his status.

Differences in findings of the internet and respondent driven sampling (RDS) surveys

Despite the fact that the RDS sample is very small and therefore, the CI are relatively wide, some statistically significant differences can be found when comparing the internet and RDS study data.

Compared to all three internet studies, the RDS study recruited fewer MSM aged 40 and older and compared to the 2007 internet study, the RDS study recruited more respondents aged 20–29 ($\chi^2 = 20.5$, $p = 0.02$). The RDS study recruited fewer bisexual MSM (compared to the 2004, 2007 internet studies; $\chi^2 = 50.6$, $p = 0.001$) and recruited men who had more tolerant attitudes toward PLWHA (compared to the 2004, 2005 internet studies; $\chi^2 = 14.3$, $p = 0.001$).

A smaller percentage of RDS study respondents compared to the internet studies reported never having been tested for HIV (compared to the 2004, 2005 internet studies; $\chi^2 = 19.7$, $p = 0.003$). The RDS study recruited more MSM who reported having two or more male sexual partners during the last six months (compared to the 2004, 2005 internet studies; $\chi^2 = 25.2$, $p = 0.001$). The RDS study recruited fewer MSM who reported having male anal sex partners in last six months but more MSM who had one anal sex partner in comparison to all three internet studies

($\chi^2 = 27.40$, $p = 0.001$). The RDS study recruited fewer MSM who reported having female sexual partners in the last six months and recruited no men having two or more female partners compared to the 2005 and 2007 internet studies which found approximately 10% of MSM reporting having more than one female partner in the last six months ($\chi^2 = 9.7$, $p = 0.05$).

Discussion

The RDS study reached a less diverse group of MSM than did the internet studies which recruited a larger proportion of MSM who were older, bisexual, had female sexual partners during the last six months, and were unlikely to have been tested for HIV.

Recruitment using RDS did not work well among MSM in T–H County. The failure to reach the sample size of 400 MSM in T–H County might be attributed to several factors specific to this population, the district, and perhaps to Estonia and some of her neighbors. Firstly, Estonia's 2004 membership in the European Union has led to high-employment rates and socio-economic development, especially in the Tallinn area. This may have reduced MSM's interest in the monetary incentive. High-employment rates for skilled and educated men may have reduced MSM's available time and interest in enrolling in the study. This is consistent with the fact that finding males to hire as RDS survey staff was unsuccessful.

Secondly, MSM already have access to voluntary Sexually Transmitted Infections (HIV/STI) counseling and testing (VCT) services and those who were not already getting tested, indicated their disinterest in, or fear of knowing their HIV/STI status. The biological testing aspect of this survey could have hindered otherwise interested MSM in participating in the behavioral aspect. In other RDS studies in countries where VCT is not readily available and medical services stigmatize MSM, the inclusion of a biological component served more as a motivator to enroll in the survey than did the monetary incentive (Johnston et al., 2008). This study did not allow participants to opt out of providing a biological specimen although, they could opt out of obtaining their test results. The future studies involving biological testing and results should involve formative research to examine whether allowing participants to opt out of providing a biological specimen would result in higher participation levels.

Thirdly, the RDS study had fewer participants who self-identified as bisexual and who reported having female sexual partners than participants enrolled in the internet studies. Through discussions during data collection, we learned that MSM with

wives or girlfriends were fearful of presenting themselves at a survey of MSM. We found that internet study participants had a larger percentage of respondents compared to the RDS study whose relatives or heterosexual friends did not know about their sexual orientation. It appears that those who participated in the RDS survey were less hidden than other types of MSM.

Finally, RDS recruitment success was based on information from only six in-depth interviews. Although, most of the MSM interviewed expressed interest, a couple had mixed feelings about their own or other MSMs' participation. Prediction of recruitment success could have been improved with more and different types of formative research.

Conclusion

Gathering accurate data on the HIV prevalence and risk behaviors among MSM has eluded researchers in Estonia. Although, MSM participation in three consecutive internet studies was relatively high, the internet does not offer the opportunity to gather data on HIV/STI prevalence. Furthermore, biases associated with data gathered through internet recruitment provide an incomplete picture of MSM characteristics.

Aside from internet sampling and other types of convenience sampling methods, a time location sampling (TLS) method to gather a probability based sample of visible MSM in T–H County could be appropriate (Magnani, Sabin, Sidel, & Heckathorn, 2005). However, there are few MSM-only venues where the proper sampling frame and random selection of clusters necessary for this sample could be targeted and according to the 2004 Internet study when MSM were asked about visiting gay-oriented bars, clubs, and saunas in the past six months, 67% of self-identified homosexuals and only 35% of self-identified bisexuals (living in T–H County) reported such venues. Sampling at these venues would miss critical portions of the MSM population.

Although, no one method appears to be ideal for sampling MSM in Estonia, the triangulation of sampling methods as well as continued qualitative research could provide useful information about HIV prevalence and risk behaviors within this group. Although, we found low HIV infection rates among MSM in the RDS survey, we only captured one man over the age of 40 and higher age groups may have higher infection rates. Findings from the internet and RDS surveys indicate low drug use among MSM. This finding is reasonable given that only 4% of IDUs sampled ($N = 350$) in a 2007 RDS study reported being homosexual or bisexual. The internet

and RDS studies indicate that a high-proportion of MSM practice risky sex behaviors and has never been tested for HIV. A sizable proportion of MSM in the internet studies has female partners increasing the likelihood of HIV/STI spread to the general population. These behaviors illustrate the need for continuous prevention work among this target group.

Currently, MSM are not a priority group in HIV prevention in Estonia. Although, the Gay and Lesbian Information Centre (the only MSM prevention service in Estonia) has existed for almost four years, many MSM in the RDS study had never visited it. More targeted approaches should be taken to attract more MSM to this center.

The internet, which provides a useful venue for delivering HIV/STI prevention and safe sex messages to MSM, could be better utilized. This is especially so, since gay-oriented bars, clubs, saunas (where condoms and lubricants are provided for free) and the information center only reach MSM in Tallinn. Finally, more creative approaches and HIV message variations could make prevention-related internet sites (and also acquaintance-oriented sites) more interesting to MSM.

Acknowledgements

The authors are grateful to the Global Fund to Fight AIDS, Tuberculosis and Malaria who funded this study through the National Institute for Health Development in Estonia. We also wish to acknowledge Estonian Gay League and Gay and Lesbian Information Centre for helping in getting to contact with MSM in Tallinn and preparing the study.

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