Size Estimation of Groups at High Risk of HIV/AIDS using Network Scale Up in Kerman, Iran

Mostafa Shokoohi[1,2], Mohammad Reza Baneshi[3,4], Ali-Akbar Haghdoost[4,2,3]

[1]Physiology Research Center, [2]Regional Knowledge Hub for HIV/AIDS Surveillance, [3]Department of Biostatistics and Epidemiology, [4]Research Center for Modeling in Health, Kerman University of Medical Sciences, Kerman, Iran

Correspondence to:
Dr. Ali-Akbar Haghdoost,
Research Center for Modeling in Health,
Kerman University of Medical Sciences
(KMU), Ebn-e-Sina Ave, Jahad Blvd,
Kerman, Postal Code: 7619813159, Iran.
E-mail: ahaghdoost@kmu.ac.ir

Date of Submission: Jan 27, 2012

Date of Acceptance: Mar 12, 2012

How to cite this article: Shokoohi M, Baneshi MR, Haghdoost AA. Size estimation of groups at high risk of HIV/AIDS using network scale up in Kerman, Iran. Int J Prev Med 2012;3:471-6.

ABSTRACT

Objective: To estimate the size of groups at high risk of HIV, Network Scale UP (NSU), an indirect method, was used.

Methods: 500 Kermanian male aged 18 to 45 were recruited. 8 groups at high risk of HIV were defined: Users of opium, unknown drug, ecstasy, and alcohol; intra-venous drug users (IDUs; males who have extra-marital sex with females (MSF); male who have sex with female sex workers (MFSW); and male who have sex with other male (MSMs). We asked respondents whether they know anybody (probability method), and if yes, how many people (frequency method) in our target groups.

Results: Estimates derived in the probability method were higher than the frequency method. Based on the probability method, 13.7% (95% CI: 11.3%, 16.1%) of males used alcohol at least once in last year; the corresponding percent for opium was 13.1% (95% CI: 10.9%, 15.3%). In addition, 12% has extra-marital sex in last year (95% CI: 10%, 14%); while 7% (95% CI: 5.8%, 8.2%) had sex with a female sex worker.

Conclusion: We showed that drug use is more common among young and mid-age males; although their sexual contacts were also considerable. These percentages show that special preventive program is needed to control an HIV transmission. Estimates derived from probability method were comparable with data from external sources. The underestimation in frequency method might be due to the fact that respondents are not aware of sensitive characteristics of all those in their network and underreporting is likely to occur.

Key words: HIV, Iran, most at risk population, network scale up

Original Article

INTRODUCTION

Based on United Nations Programme on HIV/AIDS (UNAIDS) report, by end of 2009, the estimated number of people living with HIV has been expanded to 33.3 million, and 1.8 million people die due to AIDS annually.[1] According to World Health Organization (WHO) and UNAIDS 2007 statistics, it seems that around 86,000 people living with

HIV/AIDS (PLHIV) are in Iran, showing about 100% increase comparing to the estimated number for 2001. Iran is also classified as a country with concentrated epidemic (HIV prevalence more than 5% in injection drug users (IDUs)).[2,3]

Iran has a long border with Afghanistan, which is the main opium producer in the world.[4] Therefore, drug smuggling is one of main challenges, and drug addiction is relatively common in Iran. According to UNODC report, average of opiate use in Iran rather than other countries is high. With this big problem, Iran faced with a public health crisis.[5] In addition, young population with a vast social and economical transforms have changed the pattern of relationships in the community and possibly increased some kind of risky behaviors.[4]

As the results of these events, a comprehensive harm reduction program was implemented in Iran in last decade to decrease the population size and risky behaviors of IDUs as the main most at risk populations (MARPs) in Iran.[6-11] Although many bio-behavioral studies among main MARPs have been carried out in recent years,[12-16] population size estimation (PSE) is the main missed element in the national surveillance system of HIV/AIDS in Iran. Very few published statistics is available that presented the PSE of main MARPs using a standard and validated methodology. In order to improve the current surveillance system, it is crucial to quantify the population size of groups at high risk of HIV/AIDS including addicts, drug users, female sex workers (FSW), male who have sex with male (MSM), and male who have extra or premarital sex with females (MSF). However, such groups are hidden in the community, mainly because of strong stigmatization and legal punishment.[17,18]

Although the size estimation methods of hidden populations are complicated, such statistics is fundamental for planning. This information helps policy makers in terms of the allocation of resources in their programs. In addition, it helps to monitor and evaluate the impact of public health policies.[12,19]

Special techniques have been developed to address to this need. The main ones are capture recapture, multiplier, and Networks Scale up (NSU) techniques.[20] The first 2 methods needs direct contact between research team and individuals with higher risks. In the multiplier method, a benchmark sample, and in the capture-recapture method, at least 2 representative sources of the target population are needed. These 2 techniques are more or less easy to grasp, but usually it is not easy to find appropriate sources of information. Moreover, these techniques are appropriate to estimate sizes in a close population; however, for planning, we need to have national estimates.[21-24]

The *Network scale-up* method is a relatively new technique, which needs no direct contact with individuals with higher risks. Another advantage is that the NSU method allows to estimate the size of many groups in one study and to expand the scope of the study to cover the whole country.[25,26] In this method, a random sample of general population describes their social networks in terms of their network sizes (C) and also the presences of individuals belong to special sub-populations of interest.[27] Based on the prevalence and presence of sub-populations in the social network of our sample, we can estimate the population size of sub-populations in a community.

The NSU technique has been used, mainly in developed countries. For example the size of main MARPs in the United States and Italy countries were estimated using this technique.[26,28]

However, it seems that not only in Iran but also in the Eastern Mediterranean Region (EMR) such a study was not implemented. Based on this need, we carried out this study using NSU method as one of the first studies in this field not only to estimate the size of main MARPs but also to check the practicality of this technique in Iranian culture.

Specifically, the aim of this study was to provide an estimate for the size of groups at high risk of HIV/AIDS in Kerman city. In particular, we were interested to provide an estimate for the size of the following 8 populations: 1) opium users, 2) unknown drug users; 3) ecstasy users; 4) alcohol users; 5) IDUs; 6) males who have extra-marital sex with females (MSF); 7) male who have sex with female sex workers (MFSW); and 8) male who have sex with other males (MSMs).

METHODS

This cross-sectional study was conducted in Kerman city (the capital of Kerman province), located in south east of Iran. Based on 2006 census, its total population was around half million inhabitants.

Our target population was males between 18 and 45 years old who lived in Kerman at least in the past 5 years (t = 132,651). We selected a random sample of 500 from this group to explore their social networks.

4 trained interviewers were approached for 500 participants through an adaptive purposive sampling, and filled the questionnaires in face to face interviews. All participants signed an informed consent form that it was approved by the ethic committee of Kerman University of Medical Sciences (ethic no: 202/88/KA).

The questioner had 3 main parts: 1) demographic variables; 2) questions, which measured the active social networks of participants directly; and 3) questions, which measured the frequency of individuals from sub-populations of interest among the active networks of participants. Our definition for the 8 sub-populations was at least 1 use of drugs or 1 sexual contact in last year.

Samples were selected from specific locations; 150 persons from 4 main college campuses, 290 from 11 crowded places in the city streets, and 60 in their working places.

We defined C as the size of active social network, which means the number of male between 18 and 45 year old acquaintances (colleagues, relatives, friends ….) that each person knows. Based on this concept, we defined 'know' as 'mutually recognizing each other by sign or name; can be contacted, and have had contact in the past 1 year in person, by face to face, phone or by email.

In the NSU, the sizes of reference/target population with known/ unknown sizes are shown by e/m, and the size of the whole general population is shown by t. The NSU method can be implemented applying frequency and probability approaches. In the frequency method, we ask our subjects how many individuals they know in their social networks (C) belong to the reference group (shown by m). One can simply scale up this fraction (m over C) to the target population (shown t) to get an estimate of e.[25] This indicates that $\frac{m}{c} = \frac{e}{t}$

There is an alternative formula, which estimate e based on the proportion of people who know at least 1 person from groups with known size (probability approach).[25] If Pr shows the fraction of respondents they know at least 1 member of reference groups, then $e = t\{1 - (1 - p_r)^{1/c}\}$

In both frequency and probability approaches, the 95% Confidence Intervals (CI) were estimated applying bootstrap technique using 1000 irriterations. All of computations were done in stata version 10.

RESULTS

Majority of the respondents (nearly two-third) aged 18 to 25, and were single. Furthermore, about half of subjects had academic education.

Applying maximum likelihood method, we published a paper, which showed that the corresponding C was 303[29]; i.e., each male between 18 and 45 knew around 303 males in the same age group. Our findings showed that C was more or less comparable in different age groups, with different educational level and job status.

The estimated size of groups at high risk of HIV/AIDS with corresponding 95% bootstrap Confidence Interval (CI) is summarized in Table 1. Corresponding proportions are shown in Figure 1. The main findings were as follows.

Table 1: Estimation of the size of groups at high risk of HIV/AIDS applying probability and frequency methods

Sub-populations	Probability method	Frequency method
Opium users	17327 (14419, 20235)*	3950 (3198, 4900)
Unknown drug users	5198 (4309, 6086)	1055 (548, 1720)
Ecstasy drug users	5746 (4760, 6732)	3568 (525, 9560)
Alcohol users	18163 (14980, 21347)	8983 (6527, 12343)
Injection drug users (IDUs)	1640 (1368, 1911)	3805 (57, 11254)
Males who have extra-marital sex with females (MSF)	15937 (13293, 18581)	6230 (4454, 8250)
Male who have sex with female sex workers (MFSW)	9314 (7710, 10916)	3203 (1704, 5130)
Male who have sex with other male (MSM)	3281 (2718, 3845)	713 (247, 1361)

* Estimated size (95% confidence interval by bootstrap technique using 1000 irriterations)

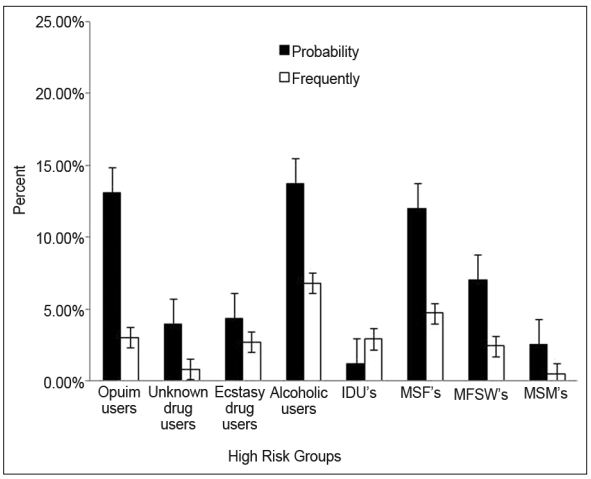

Figure 1: Estimation of percentages of population belongs to each of hard to reach groups: probability versus frequency method

Comparing the results of the probability and frequency methods

In all subgroups, except in IDUs, the estimated sizes using the probability method were greater. In overall, the ratio of the estimated sizes based on the probability versus the frequency method was 2.93 (the maximum ratio in addicts to unknown drugs was 4.93, and the minimum ratio in IDUs was 0.43).

Probability method

Population sizes of drug-related sub-groups

Based on the results of the probability method, the biggest populations were alcohol users followed by the opium users. The size of these 2 groups were 13.7% (95% CI: 11.3%, 16.1) and 13.1% (95% CI: 10.9%, 15.3%), respectively. The minimum size belonged to IDUs with 1.2% (95% CI: 1%, 1.4%).

In total, 4.3% of Kermanian males had experience of ecstasy consumption in last year (95% CI: 3.6%, 5.1%); and 3.9% had experience of unknown drug consumption (95% CI: 3.2%, 4.6%).

Population Size of Males who had Risky Sexual Contact

Regarding the risky sexual contacts, MSF had the greatest size (12%, 95% CI: 10%, 14%); followed by MFSW (7%, 95% CI: 5.8%, 8.2%).

Frequency method

Population Sizes of Drug-Related Sub-groups

In the frequency method, similar to the probability method, alcohol use was more common; 6.8% (95% C.I.: 4.9%, 9.3%). The proportion of opium users, ecstasy drugs users, and IDU's were roughly the same (range 2.7% to 3%).

Population size of males who had risky sexual contact

The estimated proportions of MSF and MFSW were 4.7% (95% C.I.: 3.6%, 6.2%) and 2.4% (95% C.I.: 1.3%, 3.9%), respectively. The proportion of MSM was 0.5% (95% C.I.: 0.2%, 1%).

DISCUSSION

Our findings showed that the results of frequency and probability methods had considerable difference; generally, the latter method estimated greater sizes. Based on the results of the probability method, the size of males with risky behaviors was considerable, particularly in using illegal drugs (opium users 13.1%, ecstasy 4.3%, alcohol users 13.7%, and IDU 1.2%). Nevertheless, the size of MFSWs, MSMs, and MSFs was also noticeable (7%, 2.5%, and 12%).

There is no official province-level data about sizes of groups at high risk of HIV/AIDS. However, based on UAIDS statistics, the estimated number of IDU's in Iran is approximately 200,000.[30] Assuming a uniform distribution across the country, the estimated figure in Kerman city would be fairly close to our estimate in probability method.

Different studies have been designed to estimate the size of hidden groups, but none of them applied the NSU approach. For example, in a study, the prevalence of opium abuse in Dashtkhak (a rural area in north east of Kerman province with very high prevalence of addition) was estimated using direct questioning; it showed that around 17.1% of males were drug users,[31] which is more or less consistent with our findings using probability method. In another cross-sectional questionnaire-based study, random sample of 652 Kermanian high school students (256 boys, 396 girls) were selected adopting stratified sampling method. It has been found that the prevalence of alcohol use among boys students in Kerman was 11.4%.[32] Corresponding figure in Tabriz was 12.7%.[33] Again, these figures were comparable with our findings using probability method.

In a cross-sectional questionnaire-based study in Tehran, a total of 8175 cases were recruited.

Proportion of alcoholic and ecstasy users, among male aged 15 to 35 years old, was 22% and 2.8%, respectively.[34]

We should emphasize that the transparency of questions is one of the issues that influences the estimates derived from NSU. In the NSU method, it is assumed that respondents are aware of sensitive behaviors of all members in their active networks; while respondents might not be aware of the sensitive characteristics of members in their networks. However, this issue is one of the limitations of the NSU method in all studies. Furthermore, we believe that the bias due to this assumption is higher in the frequency method than in the probability method. This is because, in the frequency method, respondents are requested to count the exact number of those with risky behavior in their networks. However, in the probability method, they simply reply whether they know anybody with risky behavior. Therefore, it seems that the probability method is less prone to information bias since it is much easier to recall the presence of at least one member of a sub-population rather than to count them exactly in his/her network. In other words, in the frequency method, the level of underreporting is usually more considerable. In addition, we should add the fact that the transparency of our target groups is not perfect.

CONCLUSION

As one of the first experiences in using NSU method in EMR, we showed the practicality of this technique in the estimation of the size of sub-populations with higher risk of HIV infection. Our findings showed that the frequency of drug use and extra-marital sexual contact among young and mid-age males in Kerman was relatively high with direct application in the HIV control program.

ACKNOWLEDGEMENT

This study was financially supported by Kerman University of Medical Sciences (KMU). The authors would like to acknowledge and thank all those who participated in this study. The authors also wish to thank to Mr. Ahad Asharafi, Mr. Ahmad Naghibzadeh, Mr. Navid Sadeghi and Mr. Nasroolah Jamshidi for their help in data gathering.

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Source of Support: Nil **Conflict of Interest:** None declared.