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Research Paper

National population size estimation of illicit drug users through the network scale-up method in 2013 in Iran

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ABSTRACT

Background: For a better understanding of the current situation of drug use in Iran, we utilized the network scale-up approach to estimate the prevalence of illicit drug use in the entire country.
Methods: We implemented a self-administered, street-based questionnaire to 7535 passersby from the general public over 18 years of age by street based random walk quota sampling (based on gender, age and socio-economic status) from 31 provinces in Iran. The sample size in each province was approximately 400, ranging from 200 to 1000. In each province 75% of sample was recruited from the capital and the remaining 25% was recruited from one of the large cities of that province through stratified sampling. The questionnaire comprised questions on demographic information as well as questions to measure the total network size of participants as well as the network size in each of seven drug use groups including Opium, Shire (combination of Opium residue and pure opium), Crystal Methamphetamine, heroin/crack (which in Iranian context is a cocaine-free drug that mostly contains heroin, codeine, morphine and caffeine with or without other drugs), Hashish, Methamphetamine/LSD/ecstasy, and injecting drugs. The estimated size for each group was adjusted for transmission and barrier ratios.
Results: The most common type of illicit drug used was opium with the prevalence of 1500 per 100,000 population followed by shire (660), crystal methamphetamine (590), hashish (470), heroin/crack (350), methamphetamine, LSD and ecstasy (300) and injecting drugs (280). All types of substances were more common among men than women. The use of opium, shire and injecting drugs was more common in individuals over 30 whereas the use of stimulants and hashish was largest among individuals between 18 and 30 years of age.
Conclusion: It seems that younger individuals and women are more desired to use new synthetic drugs such as crystal methamphetamine. Extending the preventive programs especially in youth as like as scaling up harm reduction services would be the main priorities in prevention and control of substance use in Iran. Because of poor service coverage and high stigma in women, more targeted programs in this affected population are needed.

Introduction

Iran's geographical location, especially its long border with Afghanistan (which is the main grower of opium in the world) and its proximity with Pakistan, has turned it into a major transit

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country for illicit drugs (UNODC, 2011). After inflation and unemployment, substance smuggling and substance use is the third major dilemma in Iranian society resulting in serious social, economical and public health consequences (Moghanibashi-Mansourieh & Deilamizade, 2014).

Most of our knowledge regarding the epidemiology and extent of substance use in Iran is based on official reports of the Ministry of Health (MOH) and Iranian Drug Control (DCHQ). Discrepancies between these reports, though, make the picture of substance use more ambiguous. In 2002, MOH and DCHQ estimated the number of substance users in the population above 15 years Because of some biases and methodological errors (e.g. sampling from emergency clinics) the results were never announced or distributed (Tafreshi, 2012). A rapid situation assessment and analysis in 2007 estimated the number of substance users to be 1.2 million (corresponding to an adult prevalence of 2.4%). The most common type of drug used was opium (34%) followed by crack (which in Iran is a cocaine-free drug that mostly contains heroin, codeine, morphine and caffeine with or without other drugs) (26.6%), heroin (19.9%), shire (a combination of Opium residue and pure opium) (4.4%), neurjezik (4.1%), crystal methamphetamine (3.6%) and hashish (2%) (Narenjiha et al., 2007). In this survey the opiate users were recruited from the street, prisons and treatment clinics in 27 cities in Iran, which may limit the generalizability of the results. The results of the latest national household survey in 2011, conducted by DCHQ on 15,000 households, suggest that there are 1.325 million substance users (corresponding to a prevalence of 2.65%) among people between 15 and 65 years old. Based on their report, the most prevalent substances were opium (52.02%), crystal methamphetamine (26.22%), crack (15.95%), heroin (9.77%), hashish (6.43%), ecstasy (3.08%) and shire (2.83%) (Sarrami et al., 2013; Tafreshi, 2012). Although these official reports provide policy makers somewhat of a snapshot regarding the situation of substance use in Iran, some practical and methodological problems (such as obtaining data from prisoners, treatment seekers and street drug users, stigma toward substance use in household surveys, and extraction of information directly from the study population) lead to certain challenges and debates regarding the pragmatic extent of substance use in Iran. Furthermore, the diversity of the study population and the methodology that was used in these surveys may limit the monitoring of trends over time. The lack of valid and generalizable information on substance use, therefore, is the main challenge of drug use surveillance in Iran.

Network scale-up (NSU) is an indirect method of size estimation in hidden populations that has been used to estimate the size of hidden populations such as HIV-positive persons (Killworth et al., 1998) substance users (Kadushin et al., 2006; Salganik et al., 2011a), men who have sex with men (MSM) (Ezoe et al., 2012) and (other) groups at higher risk of HIV (Moldova UNAIDS Country Office, 2010; Paniotto et al., 2009; Shokoohi et al., 2012) around the world. Generally, every person knows how many people he/she identifies as his/her active social network. The average number of hidden subgroups reported by every respondent constitutes a fraction of their network. We are therefore able to scale up this fraction to a fraction of the total population and thus obtain an estimate the number of hard-to-reach groups of interest (Bernard et al., 2010; Johnsen et al., 1995, 1989). The indirect nature of data collection, the ability of this method to estimate the size of different subpopulations concurrently, its low cost and simplicity makes it a feasible method for size estimation in situations where the usefulness of other methods such as enumeration, capture-recapture and multiplier is doubtful due to limited access to reliable data sources (Guo et al., 2013; Rastegari et al., 2013, 2014; Salganik et al., 2011a)

Due to the significance of determining a reliable and updated estimate of the size of the drug user population by age, gender and types of substance for policy making, planning and surveillance purposes, we designed a national survey to estimate the size of illicit drug use in the entire country using NSU methodology. The policy makers and other health professionals may benefit from the results of this study in planning prevention and treatment interventions as well as in resource allocation and in monitoring the trend over time. It seems that not only in Iran, but also in the Eastern Mediterranean Region, this is the first time such a study was implemented on a national scale.

Methods

Sampling and data collection

In this cross-sectional study we recruited 7535 individuals from all provinces of Iran. Based on a pilot study in Kerman, the lowest prevalence of a specific drug use was 1.2%, which corresponded to injecting drugs (Shokoohi et al., 2012). We set the precision to be 0.2 of prevalence and type one error at 0.05. The sample size nationally was estimated at 7000. In the end we recruited 7535 participants from 31 provinces. The average sample size in each province was approximately 400, ranging from 200 to 1000. Because about three-quarters of the Iranian population live in capital cities, we tried to keep this ratio in our sample. So, 75% of the sample from each province was recruited from the capital and the remaining 25% was recruited from one of the large cities of that province.

Eligible persons were individuals over 18 years of age who had lived in Iran for at least five years prior to the survey. We implemented a self-administered, street-based questionnaire on passersby from the general public who met the eligibility criteria. The rational for choosing these respondents was that in a previous study, we compared the odds of information disclosure in response to sensitive questions in three interview methods (street-based, household, and telephone interviews). The results showed that street-based interviewing provides a higher rate of disclosing drug-related behaviors and sexual practices than telephone and household interviewing (Haghdoost et al., 2013). Based on social and economic classes, each city was stratified into three zones. In each stratum, two to four streets were selected randomly. Because we recruited participants non-randomly, we asked our trained interviewers to recruit all age, sex and socio-economic groups into the sample via quota sampling. Quotas were set for gender (50% male, 50% female), age (50% between 18 and 30, 50% above 30%) and socio-economic status. Furthermore, we compared the sex-age distribution of sample with whole country census data, the difference was not significant. To maximize the confidentiality, we asked the interviewers not to select respondents from offices, shops, or similar places. If any invited subject refused to participate, replacement was done. The questionnaires were filled out anonymously. The questionnaire consisted of questions on demographic information as well as questions to measure the network size of participants and the number of participants in each of the seven drug use subgroups (Rastegari et al., 2013).

Applying network scale-up methodology

The NSU method is based on the assumption that by calculating the proportion of drug users in the social network of a representative sample of the general population (m/C), the prevalence of drug use in the whole population can be estimated. We calculated the average number of drug users in the personal network of participants (m) by asking them how many people they knew who belong to each of seven target groups including:

- Opium users (locally named Teriak which consisted of two types of raw opium and Sookhteh which is opium dross remaining after the opium is smoked or taken orally).
- Opium sap users (locally named Shire which is a refined product of opium that is obtained mainly from Sookhteh, with or without adding opium, boiled in water and filtered several times to remove the insoluble materials (Khademi et al., 2012).
- New synthetic drug users including: amphetamine and/or ecstasy and/or LSD (A-E-L) users.
- Crystal methamphetamine users (locally called Shisheh).
- Heroin and/or crack (H-C) users (The components of crack that is available in Iran are not the same as in crack cocaine. Instead of cocaine, Iranian crack contains mostly heroin, codeine, morphine and caffeine with or without other drugs. So because of similarities between heroin and Iranian crack, we grouped these two types of drugs together) (Farhoudian et al., 2014; Kazemifar et al., 2011).
- Hashish and/or cannabis (H-M) users.
- People who inject drugs (PWID).

The definition of "know" was "people whom you know and who know you, in appearance or by name, with whom you can interact, if needed, and with whom you have contacted over the last two years personally, or by telephone or e-mail" (Midanik & Greenfield, 2003; Rastegari et al., 2013). "Drug use" was defined as at least one occasion of substance use during the one year preceding the survey. We estimated the average network size of the Iranian population at 308 (Rastegari et al., 2013). We asked more than 7000 respondents to describe the frequency of 23 reference groups with known sizes (for example, the number of men named Hamed and the number of people who work in an elementary school) in their network. To estimate the size of substance users based on age and sex groups, we asked participant to characterize the sex and age group (<18 years, 18–30 years, >30 years) of nominated persons. We assumed that the prevalence of the reference groups in the country is proportional to that of our respondents. To exclude unreliable reference groups, regression and ratio-based approaches were followed. To validate the results, data splitting was applied. We concluded that 308 was a solid figure to describe the network size of the Iranian population. The details on estimating the network size of participants (C) and validation process are available elsewhere (Rastegari et al., 2013).

Data analysis

Since the NSU method assumes that respondents are aware of the behavior of other members of their network, and that the members of the general population have an equal chance of knowing anyone in the target group (McCormick et al., 2010; Salganik et al., 2011b; Shelley et al., 2006), we adjusted the estimates based on two correction factors: transmission and barrier ratios. As an example, a visibility of 0.50 means that crude NSU estimates must be divided by 0.5, or doubled. These correction factors were extracted from previous studies on people who inject drugs in Iran (Maghsoudi et al., 2014). Accordingly, transmission ratio and barrier ratio for all types of drug were 0.54 and 0.7, respectively. The only two exceptions were transmission ratio for Heroin/Crack (0.65) and barrier ratio for Amphetamine/LSD/Ecstasy (1). We divided the crude NSU estimate by visibility and popularity factors to adjust for these two sources of bias. To provide the uncertainty level for estimates, we applied the Monte Carlo technique. We used the below equation to estimate the 95% confidence interval for estimates.

$$je = \frac{\sum_i m_{ij}}{\sum_i c_i} \times t \times \frac{1}{vf} \times \frac{1}{bf}$$

In this equation t (the total number of the general population) and $\sum_i c_i$ the network size of respondents) are fixed but the other three components $\sum_i m_{ij}$ (number of people in a particular subgroup j that the respondent knows), vf (visibility factor) and bf (barrier factor) are random components. We assumed that $\sum_i m_{ij}$ (measured as frequency) follow Poisson distribution while vf and bf (which their values range from 0 to 1) follow uniform distribution. To provide uncertainty ranges (95% CI) for estimates, we generated randomly 1000 Poisson distribution with the mean of $\sum_i m_{ij}$ and allowed vfs vary by 10%. Percentiles of 2.5 and 97.5 were considered as lower and upper bounds of confidence interval, respectively. All analysis was done using SPSS.20 and Stata.11 software.

Ethical consideration

The study protocol was approved and reviewed by the research ethics committees of both Kerman University of Medical sciences (ethic no: 163/90/KA) and the Iranian Ministry of Health. Before gathering sufficient data and completing the required questionnaires, an informed consent was obtained from all respondents. They were assured that all information and discussions would remain confidential and were informed that their participation was voluntary. During the interviewing, participants were free to discontinue the study at any time.

Results

The analysis of data related to 7535 participants from 31 provinces showed that 48.2% of them were men and 51.8% were women (Table 1). The mean age (standard deviation) of men and women was 30.79 (11.28) and 30.80 (10.11), respectively. Age ranged between 18 and 87 years old. Over half of the participants were married (52.3%) and had a high school diploma/less than high school diploma level of education (56.9%).

Our results indicate the most common type of illicit drug used was opium with the prevalence of 1500 per 100,000 persons, that was followed by shire (660), crystal methamphetamine (590), hashish (470), heroin/crack (350/100,000), stimulants (methamphetamine, LSD and ecstasy) (300/100,000) and injecting drugs (280/100,000). All types of substance use were at least four times (for stimulants) more common among men than women (180,000 vs. 44,000, respectively). The largest difference between the two genders was related to injecting drugs in which the estimated size for men was more than 12 times higher than in women (193,000 vs. 16,000, respectively). Table 2 shows the estimated size of each substance use group in the country based on gender and age. Among three age groups, the lowest estimated size was related to the population under 18. The number of people who use opium and shire in the above 30 age group was 784,000 and 352,000, respectively which is higher than corresponding estimates both in

Table 1
Demographic information of participants.

	Demographic characteristics	Frequency (%)
Gender	Male	3584 (48.2)
	Female	3853 (51.8)
Age	18–30	3996 (53.03)
	>30	3539 (46.9)
Marital status	Single	3155 (42.3)
	Married	3899 (52.3)
	Divorced/widowed	295 (4)
Education	High school diploma/under diploma	4237 (56.9)
	University/Bachelor	2847 (38.3)
	Master and upper	358 (4.8)

Table 2
The prevalence and estimated size of various groups of drug users according to gender and age.

	Prevalence/ 100,000 population	Total estimate (CI 95%)	Men (CI 95%)	Women (CI 95%)	Less than 18 (CI 95%)	18-30 (CI 95%)	More than 30 (CI 95%)
Opium	1500	1,100,000 (973,000, 1,273,000)	1,033,000 (912,000, 1,186,000)	79,000 (68,000, 91,000)	5,400 (4000, 6900)	340,000 (299,000, 390,000)	784,000 (693,000, 897,000)
Shire	660	493,000 (438,000, 566,000)	449,000 (398,000, 515175,000)	45,000 (39,000, 53,000)	1600 (1000, 2000)	140,000 (123,000, 160,000)	352,000 (311,000, 399,000)
Amphetamine/ Ecstasy/LSD	300	224,000 (206,000, 247,000)	180000 (164,000, 200,000)	44,000 (39,000, 49,000)	15,000 (13,000, 17,000)	167,000 (153,000, 185,000)	40,000 (35,000, 45,000)
Crystal methamphetamine	590	440,000 (387,000, 502,000)	394,000 (349,000, 451,000)	46,000 (40,000, 54,000)	8000 (7000, 10,000)	253,000 (221,000, 289,000)	176,000 (156,000, 202,000)
Heroin/crack	350	262,000 (235,000, 296,000)	241,000 (214,000, 273,000)	22,000 (19,000, 25,000)	2900 (2000, 3600)	135,000 (121,000, 154,000)	124,000 (111,000, 140,000)
Hashish (cannabi0073)	470	353,000 (312,000, 403,000)	326,000 (286,000, 373,000)	28,000 (25,000, 33,000)	11,000 (9000, 13,000)	254,000 (224,000, 292,000)	87,000 (76,000, 100,000)
Injecting drugs	280	208,000 (183,000, 238,000)	193,000 (170,000, 220,000)	16,000 (13,000, 19,000)	900 (500, 1400)	102,000 (89,000, 117,000)	106,000 (92,000, 122,000)

population under 18 (5400 and 1600) and between 18 and 30 (340,000 and 140,000). Whereas regarding stimulants and hashish, the largest size pertained to individuals between 18 and 30 (253,000 for crystal methamphetamine and 254,000 for hashish) which is comparable to corresponding estimates in under 18 (15,000 and 900, respectively) and above 30 (176,000 and 106,000 in that order) groups. The lowest estimates for heroin/crack and injecting drugs was related to population under 18 (2900 for heroin/crack and 900 for injecting drugs) but there were no substantial differences between age groups above 30 and 18–30 concerning heroin/crack (124,000 vs. 135,000) and injecting drugs (106,000 vs. 102,000). Table 2 shows the total estimated size and prevalence of each type of drug use per 100,000 persons.

Discussion

This study revealed that opium, shire and crystal methamphetamine are the most common types of drugs used in Iran, but the pattern varies somewhat based on age and sex. In both genders, opium, shire and crystal methamphetamine are the three most common types of drugs used. The only difference between the two genders is that after opium, crystal methamphetamine is the second most common substance for women but the third for men. Generally, women are less affected by drugs. The estimated number of men was between four times (for amphetamine, ecstasy and LSD) and 12 times (for injecting drugs) higher than women. While older individuals tend to use traditional types of drugs, younger people are more likely to use new synthetic ones.

Although we do not have any updated official estimation with which to compare the results and cross-validate the findings, the latest rapid situation assessment of drug use and dependency in Iran (RSA), conducted in 2007, estimated the prevalence of drug use to be 2.4%. They also reported the total number of drug users to be 1.2 million, of which 200,000 of them are PWID (Narenjiha et al., 2007). Analogous to our results, the most common drugs in that study were opium, crack and heroin, in that order. Additionally, the results of a national household survey in 2011 indicated that nearly 3% of the Iranian population uses some type of drug. Based on their reports, opium, followed by crystal methamphetamine, then crack and heroin were the most prevalent types of drugs used (Sarrami et al., 2013).

Analyzing the evidence, it seems that the use of new, synthetic drugs, especially crystal methamphetamine, has become a health concern in recent years (Alam-mehrjerdi et al., 2015; Noori, 2011). The results of the RSA in 2007 indicated that 6.3% of substance users used methamphetamine. Although there are nearly 6000 centers supervised by medical sciences universities, state welfare organizations and prison organizations which provide methadone maintenance therapy (MMT) and buprenorphine maintenance therapy (BMT) for the approximately half million people who use opiates (including opium, crack/heroin and shire users), there is only a limited number of treatment clinics for other types of substances (Alam-mehrjerdi et al., 2014; Iranian Ministry of Health and Medical Education, 2015). Moreover, many individuals who undergo opiate maintenance treatment concurrently use stimulants for many reasons (e.g. feeling good and getting high in the absence of the drug) (Shariatirad et al., 2013). This situation potentially reduces the effectiveness of MMT or BMT (Shariatirad et al., 2013). Inexperience of clinicians and psychologists who are involved in MMT/BMT regarding the treatment of stimulants makes the treatment of the affected population more complicated. This results in most synthetic drug users having no access to appropriate treatment services. Therefore the extension of such treatments nationwide and revising the available treatment protocols into comprehensive guidelines which also cover modalities for parallel drug use are needed.

We have learned that the pattern of drug use varies by the age of the individual. Opium, amphetamine/ecstasy/LSD and shire are the most common types of drugs among the population over 30. In the groups 18–30 and under 18, the most common type of drug is opium then amphetamine/ecstasy/LSD. In both of these age groups, hashish and crystal methamphetamine are the second and third most common drug used. It seems that younger people tend to use new, synthetic drugs more than traditional substances while individuals in older age groups are more likely to use traditional substances such as opium and shire. Considering the psycho-social and physical complications and complexities of treatment, use of synthetic drugs has turned into one of the main challenges in relationship to substance use among youth and their families (Russell et al., 2008). Lack of appropriate knowledge, the reasonable price, ease of use and the positive attitude toward these drugs are potential explanations for the elevated tendency of youth toward new synthetic drugs. Most of substance use prevention programs among youth in Iran are implemented through the media. Education in school only covers about 8% of schools (Islamic Republic News Agency, 2015).

Gender is another challenge in control of drug use in Iran. As the results show, in both genders, opium, shire and crystal methamphetamine are the most common types of drugs used.

It is reported that between 6% and 10% of substance users in Iran are female (Noori, 2011; Khajedaluee & Moghadam, 2013; Sarrami et al., 2013; Tavakoli et al., 2014). Our estimates show that the difference between males and females may vary based on types of drugs. Although generally women are less affected by drugs than

men, current evidence suggests, despite the increasing prevalence of substance use in both genders, the rise is more accelerated in women, especially regarding stimulants (Noori, 2011). Women constitute only 2–6% of the population who seek treatment in drug treatment clinics in Iran (Tavakoli et al., 2014), which corresponds to 9600–28,800 individuals out of all 4800 treatment seekers. If we only consider the number of women who use opium (78,800) the poor availability of treatment services for women would be evident. Indeed, Iranian women experience more stigma being drug users and consequently are more reluctant to seek treatment (Dolan et al., 2011).

Regarding the registered cases of opiate users in drug treatment clinics (0.5 million) (Iranian Ministry of Health and Medical Education, 2015) our estimates indicate that less than half of opiate users are under the coverage of drug treatment centers. Additionally based on a MOH report of the half million people who received drug maintenance treatment, only 26,000 were PWID (Iranian Ministry of Health and Medical Education, 2015). Considering the estimated size of PWID in our study (208,000), this corresponds to 12.5% of all PWID. A cross-sectional study on 572 PWID in Tehran also revealed that only a small portion of PWID (9%) used drug treatment services, while majority of them (55%) had access to needle exchange programs (NEP) (Rahnama et al., 2014). It is estimated that 13.5% of PWID in Iran are HIV positive. Because this estimate has been extracted from national bio-behavioral surveillance among PWID who are referred to facilities, it cannot reflect the HIV prevalence of all PWID in the community. We therefore cannot estimate the number of HIV-positive cases based on the estimated number of this subgroup. Nevertheless, increasing harm reduction services could have substantial effect on reducing HIV incidence and transmission in this key group (Nasirian et al., 2012).

Estimations based on NSU, in comparison to both direct interview and using secondary data sources, may provide higher numbers of prevalence of drug use (Salganik et al., 2011a). This is because in direct interview, respondents usually tend to underreport their stigmatized behaviour. The main limitation of some secondary data sources, such as mandatory drug screening that are implemented before marriage, getting governmental jobs or obtaining licences, is the foreknowledge of individuals about screenings. In other sources of data, such as prison inmates and police arrestees, gender imbalance may limit the generalizability of the results (Razzaghi et al., 1999).

We acknowledge the limitations of this study. As stated later, the prevalence of all types of drug use was very low in age groups under 18. Some amounts of underestimation are possible in this age group. On the other hand about 42.5% of our sample had university degree which differs with corresponding number of 18% based on latest census in Iran. These may be because in each province, we recruited respondents from the capital city and also one of the large cities of that province. Thus because of selection bias the results could not be generalizable to rural populations. Lastly, despite the usefulness of NSU in high stigmatized setting, there is still some source of biases. Because of some practical constrains, we could not conduct separate studies among different drug user groups in each province to estimate the transmission and barrier ratio used to adjust the results. It is possible that cultural contexts affect the social transparency of drug use behavior. This effect can differ slightly in various areas of the country. Selection bias and social desirability bias could not be ruled out due to non-random sampling and interview-based nature of data collection respectively. Recall bias is another threat of validity in NSU. Salganik et al. (2011a) showed that Individuals may have tendency to overestimate the sizes of smaller populations and underestimate the sizes of larger populations. Our goal for future studies is to reduce these circumscriptions as much as possible. Nonetheless, the indirect nature of data gathering, low cost and possibility of concurrent size estimation of various groups are the main strengths of NSU for size estimation of hidden populations. The nationwide essence of study and consequently large sample size is another advantage of our study. Overall, we believe, given the scope of the study, our findings have important implications for both research and policy. To monitor the trend and evaluation of programs, we highly recommend this survey to be conducted repeatedly.

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Contributors

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References

Alam-mehrjerdi, Z., Mokri, A., & Dolan, K. (2015). Methamphetamine use and treatment in Iran: A systematic review from the most populated Persian Gulf country. *Asian Journal of Psychiatry*.

Alam-mehrjerdi, Z., Noori, R., & Dolan, K. (2014). Opioid use, treatment and harm reduction services: The first report from the Persian Gulf region. *Journal of Substance Use*, 1–7.

Bernard, H. R., Hallett, T., Iovita, A., Johnsen, E. C., Lyerla, R., McCarty, C., et al. (2010). Counting hard-to-count populations: The network scale-up method for public health. *Sexually Transmitted Infections, 86*(Suppl. 2), ii11–ii15.

Dolan, K., Salimi, S., Nassirimanesh, B., Mohsenifar, S., Allsop, D., & Mokri, A. (2011). Characteristics of Iranian women seeking drug treatment. *Journal of Women's Health, 20*(11), 1687–1691.

Ezoe, S., Morooka, T., Noda, T., Sabin, M. L., & Koike, S. (2012). Population size estimation of men who have sex with men through the network scale-up method in Japan. *PLoS ONE, 7*(1), e31184.

Farhoudian, A., Sadeghi, M., Vishteh, H. R. K., Moazen, B., Fekri, M., & Movaghar, A. R. (2014). Component analysis of Iranian crack; a newly abused narcotic substance in Iran. *Iranian Journal of Pharmaceutical Research: IJPR, 13*(1), 337–344.

Guo, W., Bao, S., Lin, W., Wu, G., Zhang, W., Hladik, W., et al. (2013). Estimating the size of HIV key affected populations in Chongqing, China, using the network scale-up method. *PLOS ONE, 8*(8), e71796.

Haghdoost, A. A., Baneshi, M. R., Eybpoosh, S., & Khajehkazemi, R. (2013). Comparison of three interview methods on response pattern to sensitive and non-sensitive questions. *Iranian Red Crescent Medical Journal, 15*(6), 500–506.

Iranian Ministry of Health and Medical Education (2015). *AIDS progress report (in Farsi)*. http://www.unaids.org/sites/default/files/country/documents/IRN_narrative_report_2015_persian.pdf

Islamic Republic News Agency (2015). *Education on fighting addiction in 8% of schools*. http://www.irna.ir/fa/News/81713411/

Johnsen, E. C., Bernard, H. R., Killworth, P. D., Shelley, G. A., & McCarty, C. (1995). A social network approach to corroborating the number of AIDS/HIV+ victims in the US. *Social Networks, 17*(3), 167–187.

Johnsen, E. C., Killworth, P. D., & Robinson, S. (1989). Estimating the size of an average personal network and of an event subpopulation. In M. Kochen (Ed.), *The small world* (pp. 159–175). Ablex Press.

Kadushin, C., Killworth, P. D., Bernard, H. R., & Beveridge, A. A. (2006). Scale-up methods as applied to estimates of heroin use. *Journal of Drug Issues, 36*(2), 417–440.

Kazemifar, A. M., Solhi, H., & Badakhshan, D. (2011). Crack in Iran: Is it really cocaine. *Journal of Addiction Researh & Therapy, 2*, 107. http://dx.doi.org/10.4172/2155-6105.1000107

Khademi, H., Malekzadeh, R., Pourshams, A., Jafari, E., Salahi, R., Semnani, S., et al. (2012). Opium use and mortality in Golestan Cohort Study: Prospective cohort study of 50,000 adults in Iran. *BMJ: British Medical Journal*, 344.

Khajedaluee, M., & Moghadam, M. D. (2013). Methods and patterns of drug abuse among young addict women. *Journal of Research & Health, 3*(4), 527–535.

Killworth, P. D., Johnsen, E. C., McCarty, C., Shelley, G. A., & Bernard, H. R. (1998). A social network approach to estimating seroprevalence in the United States. *Social Networks, 20*(1), 23–50.

Maghsoudi, A., Baneshi, M. R., Neydavoodi, M., & Haghdoost, A. (2014). Network scale-up correction factors for population size estimation of people who inject drugs and female sex workers in Iran. *PLOS ONE, 9*(11), e110917. http://dx.doi.org/10.1371/journal.pone.0110917

McCormick, T. H., Salganik, M. J., & Zheng, T. (2010). How many people do you know? Efficiently estimating personal network size. *Journal of the American Statistical Association, 105*(489), 59–70.

Midanik, L. T., & Greenfield, T. K. (2003). Telephone versus in-person interviews for alcohol use: Results of the 2000 National Alcohol Survey. *Drug and Alcohol Dependence, 72*(3), 209–214.

Moghanibashi-Mansourieh, A., & Deilamizade, A. (2014). The state of data collection on addiction in Iran. *Addiction, 109*(5), 854.

Moldova UNAIDS Country Office (2010). *Size estimation for high risk groups Moldova*. http://aids.md/aids/files/166/report-estimations-sizes-vulnerable-populations-mission-2010-en.pdf

Narenjiha, H., Rafiei, H., Baghestani, A. R., Nouri, R., Shirinbayan, P., & Farhadi, M. H. (2007). *Rapid situation assessment of drug abuse in Iran (year 2004) Research report*. Tehran: Dariush Institute.

Nasirian, M., Doroudi, F., Gooya, M. M., Sedaghat, A., & Haghdoost, A. A. (2012). Modeling of human immunodeficiency virus modes of transmission in Iran. *Journal of Research in Health Sciences, 12*(2), 81–87.

Noori, R. (2011). *Situation analysis of women drug use (in Farsi). (Strategic report)*. Tehran: Iran Expediency Council Secretariat.

Paniotto, V., Petrenko, T., Kupriyanov, V., & Pakhok, O. (2009). *Estimating the size of populations with high risk for HIV using the network scale-up method*. http://nersp.osg.ufl.edu/~ufruss/scale-up/Ukraine_Final%20Report_scale-up_eng_July24.pdf

Rahnama, R., Mohraz, M., Mirzazadeh, A., Rutherford, G., McFarland, W., Akbari, G., et al. (2014). Access to harm reduction programs among persons who inject drugs: Findings from a respondent-driven sampling survey in Tehran, Iran. *International Journal of Drug Policy, 25*(4), 717–723.

Rastegari, A., Baneshi, M. R., Haji-Maghsoudi, S., Nakhaee, N., Eslami, M., Malekafzali, H., et al. (2014). *Estimation of the annual incidence of abortions in Iran applying Network Scale Up approach*. Accepted in ircmj.

Rastegari, A., Haji-Maghsoudi, S., Haghdoost, A., Shatti, M., Tarjoman, T., & Baneshi, M. R. (2013). The estimation of active social network size of the Iranian population. *Global Journal of Health Science, 5*(4), 217–227.

Razzaghi, E. M., Rahimi, M. A., Hosseni, M., & Madani, S. (1999). *Rapid situation assessment (RSA) of drug abuse in Iran (1998–1999)*. Prevention Department, State Welfare Organization, MOH and UNODC.

Russell, K., Dryden, D. M., Liang, Y., Friesen, C., O'Gorman, K., Durec, T., et al. (2008). Risk factors for methamphetamine use in youth: A systematic review. *BMC Pediatrics, 8*(1), 48.

Salganik, M. J., Fazito, D., Bertoni, N., Abdo, A. H., Mello, M., & Bastos, F. I. (2011). Assessing network scale-up estimates for groups most at risk for HIV/AIDS: Evidence from a multiple method study of heavy drug users in Curitiba, Brazil. *American Journal of Epidemiology, 174*(10), 1190–1196.

Salganik, M. J., Mello, M. B., Abdo, A. H., Bertoni, N., Fazito, D., & Bastos, F. I. (2011). The game of contacts: Estimating the social visibility of groups. *Social Networks, 33*(1), 70–78.

Sarrami, H., Ghorbani, M., & Minooei, M. (2013). Survey of four decades of addiction prevalence researches in Iran. *Research on Addiction (in Farsi), 7*(26), 29–52.

Shariatirad, S., Maarefvand, M., & Ekhtiari, H. (2013). Methamphetamine use and methadone maintenance treatment: An emerging problem in the drug addiction treatment network in Iran. *International Journal of Drug Policy, 24*, e115–e116.

Shelley, G. A., Killworth, P. D., Bernard, H. R., McCarty, C., Johnsen, E. C., & Rice, R. E. (2006). Who knows your HIV status II? Information propagation within social networks of seropositive people. *Human Organization, 65*(4), 430–444.

Shokoohi, M., Baneshi, M. R., & Haghdoost, A.-a. (2012). Size estimation of groups at high risk of HIV/AIDS using network scale up in Kerman, Iran. *International Journal of Preventive Medicine, 3*(7), 471.

Tafreshi, H. (2012). The Statistics on Addiction in Iran (in Farsi). *Razi Journal, 23*(2), 49–56.

Tavakoli, M., Mohammadi, L., Yarmohammadi, M., Farhoudian, A., Ja'fari, F., & Farhadi, M. H. (2014). Status and trend of substance abuse and dependence among Iranian women. *Journal of Rehabilitation, 14*(5), 30–37.

UNODC (2011). *Technical cooperation programme in the Islamic Republic of Iran 2011–2014*. https://www.unodc.org/documents/islamicrepublicofiran/CP_Iran11-14.pdf