The estimated population size of injecting drug users in Sanandaj during 2015: The capture-recapture method

Ebrahim Ghaderi1✉, Khaled Rahmani1✉, Farzam Bidarpoor2✉

1 Department of Epidemiology, Social Determinants of Health Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran
2 Vice Chancellor of Deputy of Health, Kurdistan University of Medical Sciences, Sanandaj, Iran

* Corresponding author: Khaled Rahmani, Department of Epidemiology, Social Determinants of Health Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran. Tel: 0873329100; Email: Khaledrahmani111@yahoo.com

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Abstract

Background: The addicts, especially injecting drug users (IDUs), are one of the hard-to-reach groups in society; therefore, it is necessary to estimate the size of their population to conduct harm reduction and other intervention programs for them. Accordingly, this study was conducted to estimate the population size of IDUs in Sanandaj during 2015.

Materials and Methods: A capture-recapture analysis based on three sources of information was used which included drop-in center (DIC) of Kurdistan University of Medical Sciences in Sanandaj, DIC of State Welfare Organization of Sanandaj, and Triangle clinic of central prison of Sanandaj. The population of IDUs was estimated using the capture-recapture method, Bailey’s Modification, and Chapman and Peterson-Lincoln estimators.

Results: Totally, 27, 59, and 65 IDUs registered in DIC of Kurdistan University of Medical Sciences, DIC of State Welfare Organization of Sanandaj, and Triangle clinic of central prison of Sanandaj, respectively. Finally, the total size of the IDUs was estimated to be 559. It indicates that 24.3% of the cases are under the coverage of harm reduction programs.

Conclusions: The prevalence of drug injection in Sanandaj is still high; therefore, it is important to conduct harm reduction programs for this group.

Keywords: Capture-recapture, Hard-to-reach population, Injecting drug users, Sanandaj

Introduction

Drug addiction, especially drug injection, is one of the major social problems and a chief challenge facing communities in today’s world which can expose people to the risk of diseases, such as HIV (1-3). As estimated, there are over two million drug addicts in Iran of whom about 200000 cases are injecting drug users (IDUs) (4). According to statistical data published by Iran Ministry of Health, more than 280000 people with HIV have been identified so far (5) and drug injection has been the main reason for HIV transmission in 80% of the cases (6).

As defined in the HIV surveillance system, due to the stigma associated with the disease, the calculation of hidden populations and high-risk behaviors among these groups is a key element in planning (7, 8). Because of the specific cultural norms in Kurdistan Province, the identification and estimation of the number of addicts are really difficult. Consequently, it seems that new methods of population size estimation, including the capture-recapture method and network scale-up might be helpful (9).

Although no gold standard currently exists, there are different proposed methods to estimate the size of hidden and hard-to-reach populations. Such approaches as Venue-based/time-location sampling, snowball sampling, respondent-driven sampling, multiplier methods, network scale-up method and capture-recapture can be proposed for this purpose (10). The capture-recapture method is one of the main approaches to estimate the size of the hidden populations (7) which has been used in environmental studies since a long time ago (5, 11).

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In recent years, this method has been used in behavioral studies to estimate hard-to-reach human populations, such as high-risk groups of HIV/AIDS(12).

As mentioned above, IDUs are among main high-risk groups for the transmission of HIV/AIDS, especially in Iran (4). Accordingly, this study used the capture-recapture method to reach an almost exact estimation of the number of IDUs (as a hard-to-reach population) in Sanandaj.

**Materials and Methods**

The present study was a cross-sectional descriptive analytical research which was carried out in Sanandaj during 2015 using the indirect capture-recapture method.

Three sources of data which had registered the cases of drug injection addiction were used in this study. These sources were the drop-in center (DIC) of Kurdistan University of Medical Sciences, DIC of State Welfare Organization of Sanandaj, and Triangle clinic of central prison of Sanandaj.

The characteristics of the IDUs referred to the three above mentioned centers and registered from July 2013 to July 2015 were collected using the available data sources. The repeated first and last names in the lists were identified to avoid the duplication of the cases. In addition, regarding the identity of each person, the father's name, gender, and age were determined in this study. The study protocol was approved by the ethics committee of Kurdistan University of Medical Sciences, Sanandaj, Iran (IR.MUK.REC.1394.21). The participants were assured regarding the confidentiality of the information.

The registration lists of DICs included the types of high-risk behaviors and their related history. Therefore, the lists of drug users who referred to DICs and the Triangle clinic of Sanandaj prison to seek harm reduction services were reviewed to make sure that the referring drug users were on the list of IDUs. The collected data were checked using the data registered in the harm reduction office and inserted into Excel files.

Moreover, the calculations were done for pair lists and their combinations. Chapman and Lincoln-Peterson Estimators as well as Bailey's Modifications were used to estimate the total number of IDUs. In addition, the variance was calculated via the Seber method. After the estimation of the actual number of IDUs, the index of completeness of registration was calculated in each of the data sources using a more exact estimation method.

**Results**

In total, 27, 59, and 65 IDUs registered in the DIC of Sanandaj University of Medical Sciences, DIC of State Welfare Organization of Sanandaj, and Triangle clinic of central prison of Sanandaj, respectively. The total number of IDUs in these three centers was obtained as 136 cases (Fig 1).

Table 1 presents the estimated (expected) number and the confidence interval of each
estimation for different combinations of lists in the form of pairs using Bailey’s Modification as well as Chapman and Lincoln-Peterson estimators.

As shown in table 1, the lowest and highest estimations are 275 and 559 people, respectively. It means that in the most optimistic conditions 49.5\% (136/275) and in the worst conditions 24.3\% (136/559) of the IDUs are under the coverage of harm reduction programs in Sanandaj.

According to the results, the percentages of the completeness of data registration regarding various sources were different. An estimation equal to the exact number of the addicts (559) as the denominator of the fraction was used to determine the percentage of completeness. Consequently, the percentage of completeness of the registered data in the central prison of Sanandaj was obtained as 11.6\%. In addition, it was equal to 10.5\% and 4.8\% in DICs of Sanandaj and Sanandaj University of Medical Sciences, respectively.

**Discussion**

According to the results of this study based on the best model fitted to the data, the estimated total number of IDUs in Sanandaj during 2015 was 559 people. In terms of the confidence interval, the obtained number was 298.5 to 819.5 people, of whom 25.6\% of the cases were under the coverage of harm reduction programs. The number of IDUs in Sanandaj estimated via this method seems to be really high. Therefore the problem of drug abuse, especially drug injection in Sanandaj, is a very serious and important challenge as it is for other parts of the country. Moreover, the IDUs are still considered as one of the main groups exposed to the risk of HIV. Due to the changes in the pattern of this disease which moved toward a high-risk behavior, the harm reduction programs and services for this group should not be neglected.

One of the major challenges in dealing with social problems, including drug addiction, is to make an accurate estimation of the population size. It seems that the determination of the exact size of this population group is the most important step in terms of planning and implementing prevention and control programs (13, 14). The capture-recapture method, which was used in this study, is one of the statistical methods determining the completeness of each data source, the overlaps, and the size of the population (hidden population). Therefore, it provides the most realistic size of the population (15). This method has some particular limitations (16, 17) though it is still used extensively in health care programs. Héraud-Bousquet et al. conducted a study in France to determine the new cases of HIV among children from 2003 to 2006 using the capture-recapture method and three data sources. According to the results, a total of 216 cases had been registered in all three sources. In addition, the estimated number of children with HIV based on the modeling was obtained as 378 cases (18).

Similar studies have not been conducted in Iran or at least in Kurdistan province; therefore, there is no possibility to compare the results of this study with the aforementioned one (19). However, it is worthwhile to compare the results of this study with the findings of some studies which were conducted among special groups via different methods. In a study titled "Rapid Assessment of the Status of Drug Abuse in Iran", the researchers used coefficient techniques and different baseline quantities to estimate the prevalence of drug abuse among those who underwent drug abuse tests (i.e., marriage, employment, business license, and driver's license).

The results revealed that the prevalence of drug abuse in Iran from 1997 to 1998 were 2.39 and 2.88, respectively. The researchers generalized the obtained results to people aged over 15; therefore, the population of drug users was estimated at one million cases (20).
Bailey’s Modification, Chapman, and Lincoln-Peterson estimators were used to calculate different combinations of lists in pairs and ultimately estimate the hidden population size in this study. This method is one of the analytical approaches used in capture-recapture studies. The log-linear method is another approach to analyzing data regarding these types of studies, particularly when there are more than two information sources (21). It might be worthwhile from a methodological point of view to compare these two analytical approaches using the same set of data. One limitation of this study was that the data were analyzed using only one method (i.e., Bailey's Modification, Chapman, and Lincoln-Peterson estimators).

Conclusion
The prevalence of drug injection in Sanandaj is still high and IDUs is considered as a high-risk group exposed to the risk of AIDS, hepatitis C, and blood-borne diseases. Therefore, the policy makers, health experts, and other officials who are concerned with AIDS and drug abuse control programs must pay more attention to this critical issue.

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Conflicts of Interest
The authors declare no conflicts of interest.

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