



Estimating the Size of the Homeless Population in Budapest, Hungary [★]

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Abstract. In this study we try to estimate the size of the homeless population in Budapest by using two – non-standard – sampling methods: **snowball sampling** and **capture-recapture** method. Using two methods and three different data sets we are able to compare the methods as well as the results, and we also suggest some further applications. Apart from the practical purpose of our study there is a methodological one as well: to use two relatively unknown methods for the estimations of this very peculiar kind of population.

Key words: snowball sampling, capture-recapture, hidden population, homeless

1. Introduction

In Hungary since 1990, with the economical and structural changes the inequalities among the different social classes have undoubtedly been increasing. The drastically reduced number of working places, the decreasing number of new and cheap apartments (or other accommodations) built by the state, the closing down of several workers' hostels and the changing of the social benefit system all led to a growing number of poor. An increasing number of these poor people, after losing their jobs, homes, and families become in one way or another socially isolated, and sooner or later end up living in the streets and become homeless.

Before the transition the existence of a special homeless population – mainly young people running away from home (Utasi, 1987) – was acknowledged. In 1989 what took most people – social politicians, social workers, scientists and the general public – by surprise was the unexpectedly high number of homeless people emerging out of nowhere. As soon as this phenomenon came to light, the various suggestions as to how to solve this problem (providing shelters, hostels, soup kitchens etc.) were always preceded by the same question: “What is the number of

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homeless?, What is the size of the population we have to deal with?”. This question – the basis of all questions – is still unanswered.

There are two methodological problems in the estimation of the number of homeless persons in any society or geographical region. One is the definition of homeless. As Alice Johnson (1989: 13) pointed out, “. . . the standard definition to measure the phenomenon of homelessness has not been accomplished in more than 80 years of research”. The homeless, however defined, also constitute a changing population so that the definition has to make a restriction in time and space, and such a limitation has necessarily an arbitrary nature. The second problem is the ‘hidden’ nature of this population: just like, e.g., drug addicts, the homeless constitute a ‘hidden’ population in the sense that there is no sampling frame, its members are difficult to locate or to get in touch with, and it may be hard to determine whether a given individual belongs to the population of interest (Spreeen, 1992).

The problem of sampling hidden populations and some possible sampling methods are discussed in several articles: for example in Sudman et al. (1988), Watters & Biernacki (1989), Spreeen (1992), Wickens (1993), and Heckathorn (1997). Since there is, by definition, no sampling frame for hidden populations, these sampling methods are rather unorthodox. These methods, sometimes called ascending methodologies, include for example link-tracing sample designs like snowball sampling, targeted sampling, and capture-recapture methods (Spreeen, 1992). Methods to estimate the number of homeless include different types of enumeration,¹ ratios calculated from secondary data, the capture-recapture method (Johnson, 1989: 16), and so-called “network scale-up methods” (Killworth et al., 1998a: 290; Killworth et al., 1998b). In the U.S. there has been one attempt to actually count the homeless people in Chicago by Rossi and his colleagues in 1986 (Rossi, 1989).

As mentioned earlier, although homelessness is a relatively new issue in Hungary, the problems that social policy makers have to face are the same as anywhere else. In order to make any decisions they want to know numbers. Our aim in this study is to give an estimation of the size of the homeless population in Budapest by using two – non-standard – sampling methods: **snowball sampling** and **capture-recapture** method. Using two methods and three different data sets we are able to compare the methods, the results and also suggest some further applications.

This article is divided into four further sections. In the first one, the two methods are introduced, in the “Data” section the sampling and three data sets are described. The results are pointed out in the third part: three estimations on the size of the homeless population in Budapest. In the fourth part the authors suggest some points that should be considered in further researches.

2. Methodology

2.1. SNOWBALL SAMPLING

The idea of snowball sampling was introduced by Coleman (1958) as a sampling method that captures information about the social structure in the population. This is a procedure that allows the sampled units to provide information not only about themselves but also about the nominees mentioned by them (Frank & Snijders, 1994). The weakness of this sampling method is that “in the absence of knowledge of individual inclusion probabilities in different waves of the snowball sample, unbiased estimation is not possible” (Berg, 1988: 530). Also as a chain sampling method there are several problems of inference: for example the inferences about individual social actors and inferences about chains (Erickson, 1978; Snijders, 1992).

Making advantage of the possibilities snowball sampling can offer,² Frank and Snijders (1994) worked out several estimators for the size of a hidden population on the basis of a one-way snowball sample. These estimators can be calculated by a publicly available computer program (*Snowball*, available on the Web site <http://stat.gamma.rug.nl/snijders/>). In a one-way snowball sample the respondents (from an initial sample) are interviewed and asked to mention those other population members with whom they have contact. Certain criteria have to be determined by the researcher to define the population and the contact defining the relationship. In their study, Frank and Snijders discuss various models and estimators, and apply the method to estimate the number of heroin users in Groningen. The method was used also to estimate the number of cocaine users in Rotterdam (Bieleman et al., 1993: 128). In order to get a reliable estimate on the size of any hidden population, Snijders (1992 and 1993) proposes the following:

1. In theory the respondents should be a random sample from the population, but this is impossible to obtain in practice for almost any hidden population. To approximate a random sample the respondents should be obtained, as much as possible, from several independent sources (e.g., social meeting points). Whether a given population member is included as a respondent in the sample should be independent of whether the nominees mentioned by this respondent also are themselves included as respondents.
2. To obtain an estimate with a reasonable precision, the initial sample size should not be much smaller than the square root of the population size (if on average the respondents mention at least about 10 nominees; for a smaller average number of nominees, the initial sample should be larger).

2.2. CAPTURE-RECAPTURE METHOD

The other method we intended to use is the **capture-recapture method**. Unlike the snowball method, this method had already been used for estimating the size of the homeless population for example in Baltimore, USA (Cowan et al., 1986).

This method was originally developed for and used in the biological sciences to estimate fish and other animal populations, and is used now also for human populations (Sudman et al., 1988; Cormack, 1989; Leyland et al., 1992). This technique requires two or more independent observations on (i.e., lists of) the same population and it is based on the assumption that each individual has the same probability of being captured on each given list though the probability of being observed can differ between lists. If there are only two lists, it is necessary to make the assumption that these lists are independent. If there are more than two lists, a certain degree of dependence between the lists is allowed and this non-independence is expressed as interaction between the lists. Belonging to a given list is regarded as a dichotomous variable defined in the hidden population. It is assumed that population members are sufficiently recognisable on the list so that, for any individual on a given list, it can be ascertained whether this individual is also on each of the other lists. This means that, for k lists, there are $2^k - 1$ possible patterns of belonging to the lists for those who are on at least one list, plus the pattern of being on no list at all. Thus the survey is viewed as an incomplete contingency table and the value in the missing cell is to be estimated (Cormack, 1989; Wickens, 1993) (e.g., if there are three lists the complete contingency table has 8 cells, with four lists there are 16 cells.) The dependence pattern between the lists is represented by fitting a log-linear model. On the basis of this model, an estimator can be calculated concerning the size of those not listed on any of the lists. In our case the empty cell will refer to number of those homeless people who did not appear on any list. For the calculations we used the statistical modelling package GLIM (Payne, 1986).

3. Data

3.1. DEFINITIONS USED

In the introduction we already mentioned the problem of definition when trying to sample and estimate the size of any homeless population. In Hungary, Péter Gyori (1990: 305) distinguished two separate groups: the “*effectively homeless* and ... those living under the *threat of homelessness*.” He defines the effectively homeless as “those people who have no safe and certain, relatively reliable solution to the problem of where to live”.

According to the social law of 1993, there are two definitions:

1. Somebody is homeless if he/she does not have a registered permanent address or his/her registered permanent address is in one of the institutions provided for the homeless.
2. Somebody is homeless if he/she spends the nights in public spaces or in places improper for living.

In our study, apart from the official definitions we also used self-definition as an inclusion criterion: somebody was defined homeless if he/she defined him/herself as homeless. This criterion was used in the snowball sample and in the data set

that comprised the lists of those who participated in the “*Tuberculosis (TB) programme*” (Dávid et al., 1998). Coordinated by the Hungarian Maltese Charity Service, sponsored by the Soros Foundation, the TB programme – launched in 1996 – aims at screening homeless people for lung disorders. The participation in the programme is unrestricted and free for any homeless person. For each participant the lung-screening is supplemented by a questionnaire filled out by social workers. In the middle of this questionnaire the participant is asked if he/she defines him/herself as homeless.³ If the answer was no, we stopped questioning that participant: the rate of those not defining themselves homeless was about 3%. At the time of the researches all the respondents stayed in Budapest.

3.2. SNOWBALL DATA

In the 1997 *questionnaire*, the following snowball question was asked from the homeless participants: “How many other homeless persons do you know by full name? Please list them!” In our research there were no further restrictions to define the contacts. We also asked the type of relation they had: for example friend, relative or acquaintance. In 1997, 1753 homeless people were screened for lung disorders, and out of them 1435⁴ persons were surveyed. For the snowball dataset 1404⁵ questionnaires were used. Since this population is quite segregated not only from the non-homeless population⁶ but internally as well, the rate of those who could mention any other homeless person was already low (39%). For our purpose the rate was even lower: only 29% of the respondents could give full names of the persons nominated by them. In the total sample the average number of nominees was 0.82 (st. dev. 1.46), this rate among those who mentioned at least one other homeless person was 2.4 (st.dev.1.57). The rate of women among all the respondents was 9%,⁷ among those who named at least one person was 8%. Most people listed by the respondents were from the same place where they themselves usually appear or spend the night, regardless of the date of the survey: two people listed one another from the same place even if one of them was asked six months later than the first one. This probably means that those few relationships that exist between the homeless people are mainly structured around the hostels, shelters and soup kitchens they spend the days and nights in. In principle these accommodations – especially the shelters – are to provide temporal possibilities and not permanent places for the clients. The relatively low rate of fluctuation on one hand can strengthen certain relations but on the other hand it can also hinder the formation of new connections.

Due to the clustering character of the homeless relations two things may be concluded:

1. Our assumption of independence of the respondent and his nominees belonging to the initial sample can not be guaranteed.
2. Although the sample size seemed much bigger than necessary if the rule of the thumb⁸ is applied unquestioningly, and questioning took place at 11 different

sites⁹ and 30 different times throughout a year, our estimation still can be an underestimation of the total size, because there can be gathering places which were not surveyed by us, and which are totally unconnected to the places that we did survey.

3.3. CAPTURE-RECAPTURE DATA

This method – as mentioned earlier – requires two or more independent observations (lists) on the same population. For our research we were able to get two different sets of observations and calculate two estimates using the same method. The lists of the TB programme were completed by social workers, while the lists from the hospital and the hostel were filled out by the personnel of these institutions, using any kind of paper that can identify the homeless person. In several cases homeless people don't have proper ID cards; they either have several identification papers or they don't have any. This means that the same person might appear under several different names in the same list and/or in the different lists as well.

In order to avoid the duplication of the names, besides their full names homeless people were identified by their mother's name, their date of birth, and their place of birth. Those people who appeared under different names usually changed just one or two letters or maybe one identifier. In most cases we were able to detect these 'modifications', but it is still possible that some people appear in a list two times.

As mentioned before, we used two data sets, each comprising three different lists.

A. One data set includes the lists of the homeless people who were screened under "*Tuberculosis (TB) programme*" in three consecutive years (from 1996 to 1998):

- in 1996, 2030 different people were screened,
- in 1997, 1753 different people were screened,
- in 1998, 1724 different people were screened.

Since 1997, the TB screening takes place in a special bus, twice a week throughout the year. The screening sites include shelters, hostels, soup kitchens and public places. From 1998 the same person might be screened twice a year, with at least a six months interval.

B. The other data set includes three complete lists for the year of 1996:

- the names of those who participated in the "*Tuberculosis (TB) programme*" (2030 names),
- the names of those who spent at least one night in a hostel run by the Municipal Social Centre and Institutions (715 names),
- the names of those who were treated with any problem in the biggest emergency hospital in Budapest (174 names).

In all cases the numbers refer to the whole year.

4. The Results

4.1. ESTIMATIONS ON THE SIZE OF THE HOMELESS POPULATION IN BUDAPEST

As the definitions vary, so do the estimates of the size of the homeless population. In 1987, Utasi estimated that the number of people having no homes and living somewhere else lies between 30,000 and 60,000. In 1989, Györi gave an estimate of 200,000 people who are under the threat of homelessness. He used the 1980 census for his calculations. In 1993, the 'crisis-team' of the Ministry of Social Welfare stated that there were 10,000 permanent and 20,000–30,000 potential homeless people. In 1994, from the 10,000 registrations at Menhely Foundation the number of homeless was estimated to be at about 25,000 in Budapest. To our knowledge, an official consensus about the number is still lacking.

4.2. THE SNOWBALL ESTIMATE

Our original sample consisted of 1404 people who mentioned 426 names in the first wave. Of the estimators proposed by Frank and Snijders (1994), we used the estimate ν_5 , which – according to the authors – is favoured. In our case this estimate is **3444** with standard error 167.¹⁰

We already mentioned that because of the special structure of the homeless relations, this number will probably be an underestimate. To test this hypothesis we modified our original data set by restructuring it along the 11 different sites of the sampling and adding the corresponding 11 estimates. The result seems to support our assumption: in this case we obtained the estimate $\nu_5 = \mathbf{4097}$ with standard error 269, which may still be an underestimate.

4.3. THE CAPTURE-RECAPTURE ESTIMATES

The two data sets used for this procedure were described above.

A. *Data Set One* included three lists.

The matrix in Table I can be regarded as an incomplete three-way contingency table. The N values refer to the distribution of the number of people screened (or not) in 1996, 1997 and 1998: for example, the number of those homeless people who were screened only in 1998 was 1018 (1st row). In 1996, the total number of people screened was 2030, in 1997 it was 1753, and in 1998 it was 1724.

By fitting log-linear models to this data set we are able to estimate the number of those homeless people who are not on these lists, i.e., the number of people who would be in the 8th row where the matrix has three 0 values.

Based on this data set, the estimated number¹¹ of homeless persons who are not on any list is **12,345** with a confidence interval from 8,654 to 17,610 (see Appendix

Table I. The distribution of the homeless people screened in 1996, 1997 and 1998

Dates of screening			<i>N</i>
1996	1997	1998	
0	0	1	1018
0	1	0	1194
0	1	1	372
1	0	0	1581
1	0	1	262
1	1	0	115
1	1	1	72
0	0	0	–

2 for details). We can say that the size of the population of persons who were homeless in any period during the years 1996-1998 is estimated about **17,000**.¹²

B. *Data Set Two* also included three lists, all of them consisting of names from 1996.

Table II. The distribution of the homeless people in the three 1996 lists

The sources			<i>N</i>
TB screening	Hotel	Hospital	
0	0	1	108
0	1	0	436
0	1	1	32
1	0	0	1758
1	0	1	25
1	1	0	238
1	1	1	9
0	0	0	–

In the three 1996 lists the distribution of the homeless people is quite diverse. The overlap seems to be smaller than in the previous data set. This character of the data set is also indicated by the standard errors of the final estimates¹³ of the log-linear model: they are about 0.4 on the logarithmic scale.

By fitting log-linear models to this data set, the estimated number of homeless persons we got is 3.913 with a confidence interval from 1.605 to 9.545. Based on this estimate, we can say that in 1996 the size of the total homeless population was about **6,500**.

4.4. ESTIMATING THE SIZE OF THE HOMELESS POPULATION IN BUDAPEST FROM 1996 TO 1998

Finally, we would like to present the estimates on the size of the homeless population from 1996 to 1998 based on our calculations and other available statistical data. Considering the results, we will give an estimate on the number of homeless people in 1999.

There are two types of statistics that we used:

1. The number of the total places (beds) available for homeless people in Budapest. This includes for example shelters, hostels and special rehabilitation centres and wards. According to this data, in 1996 the total number of places available was 3410, in 1997 it was 3578, in 1998 it was 3632 and in 1999 it is 3726. (This number might change by the end of the year.)
2. From two surveys in 1997 and in 1998, we have statistical data on the rate of the 'incomers' who became homeless in the year of the questioning. In 1997 this rate was 12% and in 1998 it was 11%. Since we almost know nothing about the rate of those who are able to reintegrate permanently¹⁴ to the mainstream society and since there is no data on the rate of the fluctuation of the homeless between Budapest and other places in the country it is very difficult to estimate any increase or decrease in numbers in a short period of time and place. Generally we can say that the number of 'incomers' is probably higher than the number of 'outcomers';¹⁵ therefore we expect the homeless population to be still increasing.¹⁶ Although there is an increase in the number of places available each year, it probably can not follow the actual growth and needs of the population.

Table III. The total number of places available for the homeless in Budapest and estimates of the homeless population from 1996 to 1998

	1996	1997	1998
Total number of places available for the homeless in Budapest	3410	3578	3632
Snowball estimate		4097	
Capture-recapture estimates			
Data set two	6519		
Data set one		16959	

From Table III, we can see that the difference between the snowball estimate and the numbers referring to the available places is not very large. It is possible that the presumed structuring¹⁷ character of the homeless relations affected the snowball sample in such a way that the estimate mainly refers to the number of those homeless who have 'stable', permanent places. Because of the 'place factor' our snowball estimate is probably an underestimate of the total number of homeless people, omitting the number of those who are isolated because of their temporary possibilities of living.

In order to get a more reliable estimate by using snowball sampling method we suggest that the sites of the survey should be chosen even more carefully. It is not only the number of the different (quasi independent) sites that is important but rather the type of that site. For example, future researches using this method should sample, e.g., in hospitals where the chance for the homeless people to be independent of each other is higher than in a shelter or in a soup kitchen.

Comparing the estimates of the snowball method and the capture-recapture method there is a discrepancy between the snowball and data set two on one hand, and data set one on the other hand. The discrepancy might be explained by the different sampling method used in data set one: the homeless might tend to take care that they were checked for TB in at least one of the 3 years 1996-1998, which would imply a log-linear model with a 3-factor interaction, untestable from the incomplete contingency table, so the number of homeless not checked at all during these years is lower than expected from the loglinear model. The lower number might be also the result of the fluctuation of the homeless population: people might have turned up for the screening then left Budapest and reappeared again in one of the following years.

Our estimate regarding the size of the homeless population in Budapest in 1999 is based on the following results:

1. The snowball estimate is an underestimate because of the clustering effect in the initial sample.
2. The capture-recapture estimate based on Data Set Two yielded the highest value with the largest confidence interval: because some of the figures in Table II are very low (down to 9), this might lead to statistical inaccuracy.
3. The estimate based on Data Set One refers to a 3-year period where the number expected for one year is probably also an underestimate.

Considering our estimates and the available statistical data we assume that the number of the homeless population is increasing. If the average rate of this increase is at least 10% per annum from 1996, we are able to give a rough estimation on the size of the homeless population for 1999. According to our calculations this number is between 8000 and 10 000 in Budapest.

5. Conclusion

Anybody attempting to estimate the size of the homeless population has to be very cautious and careful. This is a very controversial area where there are no strict gridlines, where there are several official and non-official opinions and versions which all seem to be correct and true. Politicians, social workers, and scientists can debate endlessly on the numbers without ever arriving at a consensus.

By using two methods based on statistical methods that were never used in Hungary before, we tried to approach the question from a new and different angle. As a result, we got three estimates. With the estimators and other available statistical data we attempted to give an estimate on the actual size of the homeless population in Budapest, in 1999.

Fortunately we think this research is just the beginning. We hope to get new and different data with which the estimators can be easily tested, and the methodology can be further applied to estimate the size not only in Budapest but in the whole country as well.

Notes

1. For example service utilization data, census or survey data.
2. It can provide information about people that are otherwise 'hidden' for standard sampling methods.
3. We included this question because sometimes poor but not homeless people also turn up and want to be examined.
4. Especially at the beginning of the programme the social workers who were supposed to fill out the questionnaires and examine the participants did not have time to do both. Since the main objective of the programme is the screening, in such cases the social workers omitted the surveying of a few participants.
5. 31 questionnaires were impossible to identify.
6. 38% of the surveyed population has nobody to turn to, 23 % turns only to non-homeless people.
7. This is about the usual rate. Depending on the place of the surveys the rate varies between 9-22%.
8. As mentioned before, the sample size should be bigger than the square root of the total population, therefore among 'normal' conditions about 200 people could have been enough. But since the homeless people turned out to be very isolated not only from the non-homeless population but from each other as well, our sample size was just big enough.
9. Among them were day-shelters, public places and hostels, only in Budapest.
10. Both the computer commands and the results in detail can be obtained from the first author.
11. Again, the computer commands and the results in detail can be obtained from the first author.
12. This is the sum of the numbers in the eight rows: $1018 + 1194 + 372 + 1581 + 262 + 115 + 72 + 12345 = 16.959$, rounded in view of the large uncertainty.
13. Results in detail can be obtained from the first author.
14. It often happens that homeless people can live with a friend or relative for a few weeks then go back to a shelter or hostel again.
15. The number of those who die or those who are able to reintegrate permanently.
16. The figures in the 1999 Annual report of the City Council of Budapest about the Homeless people also show that the number of the homeless is still increasing.

17. This means that people know each other mainly from the same places where they usually spend the night and day. The rate of knowing any other homeless person is the highest among those who spend the nights in hostels, which are the most permanent places for sleeping.

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