Estimating the number of street children and adolescents in two cities of Brazil using capture–recapture

Kátia Floripes Bezerra,1 Ricardo Queiroz Gurgel,2 Chinenye Ilozue4 and Daniel Neyra Castaneda3

1Health Sciences and Departments of 2Medicine and 3Statistics, Federal University of Sergipe, Aracaju, Brazil and 4Liverpool School of Tropical Medicine, University of Liverpool, Liverpool, United Kingdom

Aim: To use the capture–recapture method to estimate the number of street children and adolescents in Maceió and Arapiraca, north-east Brazil, and describe the characteristics of the two populations.

Methods: The number of children and adolescents on the street in Maceió and Arapiraca was estimated using the multi-list capture–recapture method. Two street surveys and an official list from the social services department were compared. The characteristics of the children were recorded during the street surveys using a questionnaire.

Results: The estimated number of street children and adolescents was 5225 in Maceió and 1191 in Arapiraca. According to the official records, the population registered was 565 and 157, respectively. Most individuals were male (71.4% and 71.8%, respectively). They still maintain contact with their families (85.5% in Maceió and 89.6% in Arapiraca) and attend school regularly (43.4% and 49.7%). Drug use was admitted by 46.9% of the individuals in Maceió and by 26.9% in Arapiraca. In both cities, glue inhalation, associated or not with other drugs, was most frequently cited.

Conclusions: Children and adolescents on the streets are a common and underestimated occurrence in Maceió and Arapiraca. They have similar characteristics to street children from other countries and other cities in Brazil. The method of capture–recapture seems to be suited to study populations such as street children.

Key words: Brazil; capture–recapture; epidemiology; street children.
method also assumes that the population is homogeneous and that the sources used are independent, allowing every population individual the same chance of inclusion in the lists.  

Street living is frequently associated with drug abuse and illegal activities, and official governmental structures frequently treat the problem with a repressive approach. This kind of intervention makes knowledge of the real motivations and habits of the youngsters difficult to obtain or biased. Previous studies have shown that, in middle-size cities, drug use may be much less frequent than in large cities. There is no information, except from non-governmental unsystematic listings, about the size of the SC population in Alagoas state in Brazil. This state, one of the poorest and with the worst social indicators of the entire country, is located in the north-east region. Maceió is the capital city, has a population of 903 463 and, together with Arapiraca (population 199 964), is one of the two largest cities in the state. We chose these two cities to evaluate the CRC method because of their different sizes and proximity to Aracaju, where the method was used successfully.

**Materials and Method**

To estimate the size of the SC population in Maceió and Arapiraca, we used three independent lists. Two of the lists for each city (lists A and B) were built after street surveys on two different days (Wednesday and Saturday) of 1 week. The third list (list C) were obtained from the municipal secretary of citizenship and social assistance in Maceió and from the public prosecutor office in Arapiraca. They were considered as representative of the official number of SC in both cities.

During the street surveys to obtain individuals for lists A and B, after oral consent, the adolescents and children were briefly interviewed about their activities when in the streets, links with the family, reasons for being in the street, amount of money earned, attendance to school, habits and drug use. For the surveys, we used 12 (Maceió) and 10 (Arapiraca) pairs of interviewers located in strategic points (and their surroundings) of the city, from 8:00 AM to 7:00 PM. The points were previously determined because of the known concentration of SC in the areas. We used the same strategy in the same areas twice, one in a week day and the other in a weekend day, to avoid missing children who attend school during the week but are in the streets later on. The identification of individuals in the three lists was obtained using the following information/identifiers: name of the child/adolescent; nickname; name of the mother and father; sex; and age. If 'name' and two other identifiers were the same (or very close because of name spelling), the individual was considered the same. This strategy was used in Aracaju and was considered adequate.

Capture frequencies were entered into the ‘Recapture’ package of R version 2.10.1 (R Foundation for Statistical Computing, Vienna, Austria). The function ‘closedp’ ran several log-linear models for a closed population for more than two lists. The function for closed populations was selected for use here as all data were collected within a single week, and, as such, we would not expect any significant movement or changes within the SC population. Furthermore, interaction terms were modelled using the function closedp.mX to account for any between-list dependence. The output of the analyses produced estimates of population size with standard error, deviance and Akaike’s information criterion (AIC) statistics to enable selection of the best fitting model. The use of information criteria such as AIC to select the most appropriate model is widely adopted in CRC and is related to the likelihood ratio statistic of the model. This process enabled selection of the most appropriate model by the lowest AIC value, having excluded implausible models. For the selected model, the function ‘profileCI’ was run to calculate the population estimate maximising the multinomial likelihood. This function also produced the 95% profile likelihood confidence interval (CI) for the estimate. The use of likelihood profile CIs, as proposed by Cormack, is preferable in CRC as the population is skewed, and normal distribution CIs produce unreliable results. By this method, an estimate of the number of SC was obtained for both cities individually.

Data obtained with the questionnaires are presented using descriptive statistics in absolute numbers and percentages. The χ² test was used to comparatively analyse certain characteristics of the SC populations. It was applied to compare the frequency of activities by sex to assess if main activity in the street was significantly different for girls or boys, with significance level established as P < 0.05.

This study was approved by the Ethics Committee, Federal University of Alagoas before the beginning of data collection (6 November 2004).

**Results**

The distribution of individuals in the three lists and their intersections from Maceió are represented in the Figure 1. There were 225 individuals in the first survey (list A), 266 in the second survey (list B) and 565 in the official governmental list (list C). The estimated number of SC in Maceió was 5225 (95% CI 3964–7196) (Table 1). There was an estimate of 4220 individuals that were not included in any of the three lists (n000).

For Arapiraca (Fig. 2), the numbers are: 106 individuals in list A; 92 in list B; and 157 in list C (official list). The estimated number of SC in Arapiraca was 1191 (95% CI 877–1737) (Table 1), and the estimate of individuals not included in any list was 875.

Characteristics of both cities’ populations were similar in most cases. The majority of SC were males (71.4% in Maceió and 71.8% in Arapiraca) and were born in the same city where they were living (73.4% in Maceió and 73.5% in Arapiraca). More than half (56.6% in Maceió and 50.3% in Arapiraca) had dropped out school, but 85.5% in Maceió and 89.6% in Arapiraca still had regular contact with their families (data not shown).

Working activities provided an average weekly income between 10 to 50 reais (US$ 5–25) for almost 2/3 of the SC (62.2% in Maceió and 64.3% in Arapiraca). To investigate the kind of activities they developed when in the streets, we asked the SC from Maceió and Arapiraca what they did to earn money. Information was collected on the main activity for each child and adolescent (defined as that which occupied the majority of time) (Table 2). Activities were different between sexes and cities. Males were mostly porters and goods sellers (31.7% in Maceió and 45% in Arapiraca), or shoe and car cleaners (25.4% in Maceió and 12.7% in Arapiraca)....
during ‘Dias de Feira’ (days of the week) where commercial activities increase because of particular reasons in each city, and they have more opportunity to work, for example, as porters. There were 10–12 pairs of interviewers at differing locations in the two cities so appearance in one survey was unlikely to affect the likelihood of being picked up in another survey at a different location on a different day. Thus, this small overlap is unlikely to represent a negative dependence of the lists. Furthermore, we know that from the three lists (A, B and C), the population demographics are comparable, indicating that the lists come from the same overall population. Additionally, the model selected incorporated the most significant interactions between sources, and the heterogeneity plots of the data are more or less linear, demonstrating that both populations were reasonably homogenous (Fig. 3). Thus, we can assume that the reason for the small amount of overlap is because the population is genuinely very large. Another potential limitation is that the model assumes a closed population, which is not true of SC – being dynamic by their very nature. However, in this case, all the surveys were carried out within the space of 1 week so there is a low likelihood for significant migration of SC in or out of the area. In addition, the surveys carried out at different locations in each city maximised inclusion of SC from the entire city, thus negating the effect of any migration within the cities themselves. Therefore, we can consider that the population in the two cities was closed within this very short study period, thus fulfilling the assumption for the model.

Another potential limitation relates to the street surveys. There were perhaps young people with similar names; however, as age and parents’ names were also used for matching, this reduced the risk that different individuals with similar names were matched erroneously.

The two cities are the largest in Alagoas state with populations of 903 463 (Maceió) and 199 964 (Arapiraca). Alagoas state has some of the worst socio-demographic indicators of the entire country, and the general perception is that SC is a real problem for the poor population. When compared with Aracaju city (less than 300 km away), the number of SC estimated was much more than would be expected considering the sizes of the cities. Aracaju has a population of 536 785, and the estimated number of SC using CRC was 1456 in 2003. Maceió’s population size is 68% bigger than Aracaju’s, but the number of SC is over 3.5 times bigger. Comparison of social indicators may help to understand why the number of SC in Maceió is so much higher. Infant mortality in Sergipe state in 2004 was 35.2‰, while in Alagoas, infant mortality was 49.4‰ in the same year. The proportion of the population under the poverty line was 63.1% in Alagoas, while in Sergipe, this was 45.3%, and gross internal product per capita was R$ 3011 and R$ 5082, respectively. For Maceió city, the Human Development Index was 0.739 in 2005, while for Aracaju, this index was 0.794 at the same time.

CRC use in epidemiology is already well established, and the method has been used to estimate the prevalence of different conditions such as type 2 diabetes, infantile spasms and drug use. Traditional census methods such as prevalence surveys and active/passive surveillance are invariably incomplete and do not take into account the possibility of missing or undetected cases. This is reflected in the official figures of SC in the two
cities from the municipal secretary of citizenship and social assistance in Maceió and the public prosecutor office in Arapiraca. These lists were compiled from SC in families registered to receive social assistance and those having had contact with police and judicial bodies. These official lists are regularly updated and so were comparable with the street surveys at the time of research. SC in Latin America are a real and long-lasting problem as acknowledged from different sources.26,27 There are several studies showing their existence and characteristics, 2,4,26 but the problem of estimation of their real number is recognised. They constitute an elusive population, with bad experiences with official bodies, suffering abuse and violence on a regular basis.6,28

A particular characteristic of SC in Maceió and Arapiraca is that although they spend many hours in the streets, they still have links with their families. This seems to be a common situation in Latin America and was observed in Aracaju,7 Porto Alegre26 and João Pessoa,29 but is much different from what happens in Africa.1,27 Internal migration seems to play a role in family disorganisation, leading to children in the workforce becoming necessary, almost mandatory.4,7

The main reason expressed for SC to be in the streets is to help with the family budget,27,29 and the predominance of boys in the SC population is widespread,27,28 also evident in Maceió and Arapiraca. Similar numbers of girls work outside their homes, as domestic workers for the middle and rich classes, but as these girls are not in the streets, they are not considered as SC, although they are involved in child labour. The girls are also submitted to high-risk activity in the streets as sex workers. This may be a consequence or even the reason for them to go to the streets, and exposes them to the huge risk of contracting sexually transmitted infections, including human immunodeficiency virus/acquired immune deficiency syndrome.30,31

In Maceió, female SC are predominantly goods sellers or beggars, but there are some involved in illicit activities. This situation was not found in Arapiraca, probably because of the city size and the low tourist appeal of the city. In this city, only

### Table 1: Best fitting models of abundance estimations for Maceió and Arapiraca

<table>
<thead>
<tr>
<th>Location</th>
<th>Abundance</th>
<th>Standard error</th>
<th>Deviance</th>
<th>Degrees of freedom</th>
<th>AIC</th>
<th>Abundance (corrected)</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maceió</td>
<td>5239</td>
<td>796.1</td>
<td>16.9</td>
<td>2</td>
<td>65.2</td>
<td>5225</td>
<td>3964–7196</td>
</tr>
<tr>
<td>Arapiraca</td>
<td>1197</td>
<td>209.6</td>
<td>3.1</td>
<td>2</td>
<td>47.8</td>
<td>1191</td>
<td>877–1736</td>
</tr>
</tbody>
</table>

Abundance, population estimate; abundance (corrected), population estimate (corrected to maximise multinomial likelihood); AIC, Akaike’s information criterion; CI, profile likelihood confidence interval.

### Table 2: Self-reported activities of street children and adolescents according to sex, 2005

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sex</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Maceió</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porter and good seller</td>
<td>106</td>
<td>31.7</td>
</tr>
<tr>
<td>Shoe and car cleaner</td>
<td>85</td>
<td>25.4</td>
</tr>
<tr>
<td>Criminal activities</td>
<td>20</td>
<td>6.0</td>
</tr>
<tr>
<td>Beggars</td>
<td>62</td>
<td>18.6</td>
</tr>
<tr>
<td>Other</td>
<td>61</td>
<td>18.3</td>
</tr>
<tr>
<td>Total</td>
<td>334</td>
<td>100</td>
</tr>
<tr>
<td>Arapiraca</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porter and good seller</td>
<td>59</td>
<td>45.0</td>
</tr>
<tr>
<td>Shoe and car cleaner</td>
<td>46</td>
<td>35.1</td>
</tr>
<tr>
<td>Criminal activities</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Beggars</td>
<td>3</td>
<td>2.3</td>
</tr>
<tr>
<td>Other</td>
<td>21</td>
<td>16.0</td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td>100</td>
</tr>
</tbody>
</table>

χ² = 40.9; P < 0.001. –, Nil reported.
The method seems to be suitable to effectively evaluate SC populations and may be used to compare different places or the same place after specific interventions or changes. Such research into the prevalence of SC in Brazil can form the basis for advocacy to local and national governments and authorities. Lobbying for implementation of social programmes that aim to improve the living standards of the poorest families is necessary to reduce the need for their children to go to the street to seek income. Interventions and policies such as Programa Bolsa Família have been initiated with support from the evidence presented from research into SC, poverty and other important socio-demographic factors, validating the importance of such research. In this case, awareness that the numbers of SC in Maceió and Arapiraca are much higher than previously appreciated will enable local authorities to plan more effective health and social policies to address this disadvantaged and significant population. It will also serve as a basis for further study into the specific needs of these SC in terms of health, education and development.

Acknowledgements

This work is part of KFB’s master thesis in Health Sciences at the Federal University of Sergipe supervised by RQG.

References


