



On A Method of Estimating the Hidden Population of Drug Addicts

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Abstract

The consumption of drugs like Tramadol, skutches, Skunk, Loud and Indian hemp are illegal in Nigeria and the increasing addiction of youth to drugs of different forms is very evident in the society. This trend is of great concern with no effective approach to deal with the problem primarily because it involves a hidden population. This study considered the estimation of the hidden population size of drug addicts in Ekiti state, Nigeria between 2015 and 2016, using Capture-Recapture (C-R) method. Two data sources namely National Drug Law Enforcement Agency (NDLEA) and psychiatric unit of Ekiti State University Teaching Hospital (EKSUTH) were used and The lists of individuals collected from the two data sources were used to estimate the population size by identifying the number of individuals that appeared in one or two of these lists. Results showed that the estimated hidden population size of drug addicts in Ekiti State during the study period is 201 leading to the total population of 558 with a 95% confidence interval (486, 636).

Keywords: *Drug-addict, hidden population, capture-recapture (C-R), (NDLEA), psychiatric unit and estimate the population.*

Introduction

The consumption of drugs like Tramadol, skutches, Skunk, Loud and Indian hemp by youths are illegal in Nigeria and the increasing involvement of people in drug addiction is very evident on the street, in schools, market places, motor parks to mention a few. This trend is of great concern to the parents, government and non-governmental organizations but they find it difficult to formulate a comprehensive approach to deal with the problem primarily because it involves a hidden population. One of the methods used in the social sciences for estimating number of drug addicts is Capture-recapture (C-R) methods (Roberts and brewer 2006). Although Capture-Recapture technique was first introduced and reported in Lincoln (1930) to estimate the total number of ducks in North America. The same method was adopted in Jackson (1933) to estimate the true density of tsetse flies. The method has also been successfully applied to

natural populations like moths by Fisher and Ford (1947) caught, marked and released on several different days. Capture-Recapture (C-R) method had been used by ecologists to study different animal populations that are difficult to enumerate and followed over time. After trapping, marking, and releasing individuals on one or more capture occasions, inference about the population is obtained by comparing numbers marked and unmarked individuals captured at subsequent times (Bonner and Schwarz, 2006).

In recent years the Capture Recapture method has increasingly been used in epidemiology to determine an estimate of disease occurrence by using a number of different sources (Britain and Bohning, 2008). The method was also used to estimate birth and death rates and extent of registration in an area near Calcutta, Indian, Sekar and Deming (1949). Shapiro (1949) applied the technique to the birth registration in the United States using census data. Working group for

disease monitoring and forecasting (IWGDMF 1995) applied the method to estimate death in a region close to Calcutta, India and remarked that capture recapture maybe the ideal techniques for assessing the frequency of diseases in developing countries.

Sutherland, Schwarz and Rivest (2007) used the C-R method to estimate the number of children with neural tube defects (NTD) and the number of people with diabetes. You and Mao(2008) also reported that C-R method is widely adopted to estimate sizes of populations of public health interests using information from surveillance system. Whitfied and Kelly (2002) adopted the C-R method in the study of the annual incidence of acute flaccid paralysis with highly successful findings with their results helping to define a target notification rate for surveillance in settings where poliomyelitis is not endemic. Laska (2002) noted that capture recapture techniques are often much less expensive and may be more informative than classic approaches to case finding and concluded that those interested in the size of difficult to identify populations will undoubtedly find the estimation procedures based on the method appealing.

The C-R approach uses the list of individuals derived from two or more multiple sources to estimate the hidden population which leads easily to the total population by identifying the number of individuals that appear in one or more of the lists.

In this work, the estimation of the hidden population and the proportion of drug addicts in Nigeriawere considered using C-R method.

Materials and Methods

Capture recapture involves the collection of two or more sources of data on drug addicts. Information on the number of matches between the data sources (the number of drug addicts that appear in more than one data sources) is used to estimate the proportion of the hidden population number of drug addicts in the sample. These are combined to generate the total population size estimate.

The two sample capture recapture method is the simplest model which can be arranged in a 2×2 contingency table. The objective is to estimate the hidden population of drug addicts that are not appeared in both records (a_{00}). Lincoln Peterson estimator or dual system estimation would be used to estimate the hidden population of drug addicts using information on drug addicts captured on both records and on drug addicts captured only in one record, thus providing the total population size N.

Lincoln Petersen estimator for two sample capture recapture

Let N be the total number of individuals in the population of interest. Let a_{11} denote the number of drug addicts observed to be in both NDLEA and psychiatric unit hospital records. Let a_{10} denote the number of individuals observed to be in the NDLEA record but not in psychiatric unit’s hospital records. Let a_{01} denote the number of drug addicts observed to be psychiatric unit hospital records but not in NDLEA records. Let a_{00} denote the number of drug addicts not in both NDLEA and psychiatric unit hospital records . Finally, let n_1 and n_2 denote the total number of drug addicts in NDLEA and psychiatric unit hospital respectively.

Table 1.0

| | Psychiatric Hosptital | | TOTAL |
|---------|-----------------------|----------|-------|
| | 1 | 0 | |
| NDLEA 1 | a_{11} | a_{10} | |
| 0 | a_{01} | a_{00} | |
| TOTAL | | | |

If the capture recapture are independent then the number of hidden population of drug addicts (a_{00}) can then be estimated using the independence assumption as follow:

$$\frac{a_{11}a_{00}}{a_{10}a_{01}} = 1 \quad (1)$$

We can use this assumption of independence to give us an estimate for a_{00}

$$a_{00} = \frac{a_{10}a_{01}}{a_{11}} \quad (2)$$

The Lincoln Peterson estimate is given that by

$$N_{L.P} = a_{11} + a_{10} + a_{01} + a_{00}$$

$$N_{L.P} = a_{11} + a_{10} + a_{01} + \frac{a_{10}a_{01}}{a_{11}}$$

Therefore, estimated total population is

$$N_{L.P} = \frac{n_1 n_2}{a_{11}} \quad \text{Where,} \quad (3)$$

$$n_1 = a_{11} + a_{10}$$

$$n_2 = a_{11} + a_{01}$$

Variance estimation

Unbiased estimate of the variance is given as follows:

$$\text{Var}(N) = \frac{(a_{11} + a_{10}) \times (a_{11} + a_{01}) \times (a_{10} + a_{01})}{(a_{11})^3} \quad (4)$$

While the confidence interval is of the form, $CI = N \pm 1.96 S.E$

Data Layout

The two sources of data on drug addicts used for this study are from National Drug Law Enforcement Agency (NDLEA) and psychiatric unit of Ekiti State Teaching Hospital Ado-Ekiti (EKSUTH). They were obtained as secondary data. The data collected were first cross tabulated into 2×2 contingency table. Name and age were used simultaneously to match individual from one list to the other making it a dual system for each list. In this work, we consider the application of the C-R technique to estimate the hidden population and proportion of drug addicts in Nigeria using two data sources.

Assumptions of Lincoln Peterson estimator for two sample capture recapture

- The samples/lists must be representative of the population under study, which has to

be 'closed' (closed refers to the assumption that individuals do not enter or leave the population during the study period.)

- The population interest is homogenous in the sense that each member of the population has equal chance of being captured for a given list.
- Lists are independent

Analysis

The Capture Recapture was used to identify the number of drug addicts in National Drug Law Enforcement Agency and Psychiatric Unit of EKSUTH with both treated as independent lists. The population which does not appear in any of the samples used is referred to as the hidden population. This is the unknown values for which capture recapture is set out to obtain as estimate.

Tab3.1 The number of individuals in NDLEA and PSY registers by Gender and year

| Population | | NDLEA | PSY | MATCHES |
|--------------|--------|------------|------------|-----------|
| 2015 | Male | 57 | 92 | 31 |
| | Female | 22 | 43 | 13 |
| 2016 | Male | 61 | 107 | 27 |
| | Female | 18 | 37 | 9 |
| Total | | 158 | 279 | 80 |

Source: NDLEA office, Ekiti State Command and Psychiatric unit, EKSUTH Ado Ekiti

Venn diagram

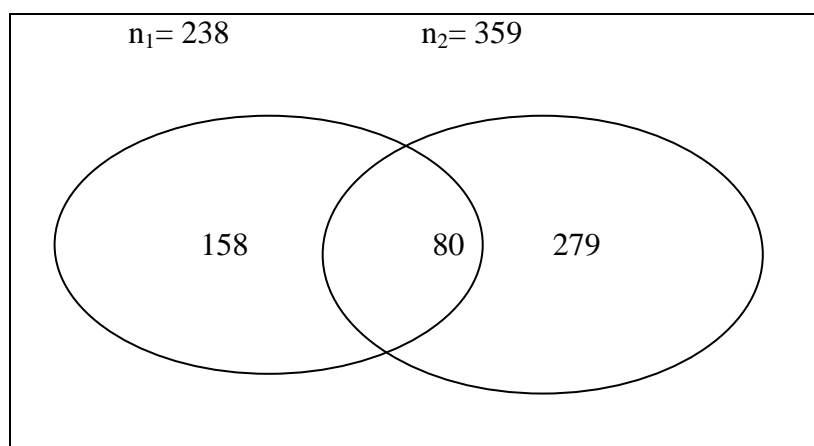


Fig 3.1 The NDLEA and Psychiatric Hospital sources identified 158 and 279 addicts, respectively, and 80 where common to both sources.

Table 3.2 Estimated hidden population of drug addicts by gender and year

| Population | | Estimated hidden number | Proportion | % |
|--------------|--------|-------------------------|------------|------------|
| 2015 | Male | 51 | 0.25 | 25 |
| | Female | 21 | 0.11 | 11 |
| 2016 | Male | 101 | 0.50 | 50 |
| | Female | 28 | 0.14 | 14 |
| Total | | 201 | | 100 |

In the table 3.2 shown above, Petersen – Lincoln estimator was used to estimate the hidden number of drug addicts. The results showed that male had a higher estimated number of hidden population of addicts between 2015 and 2016.

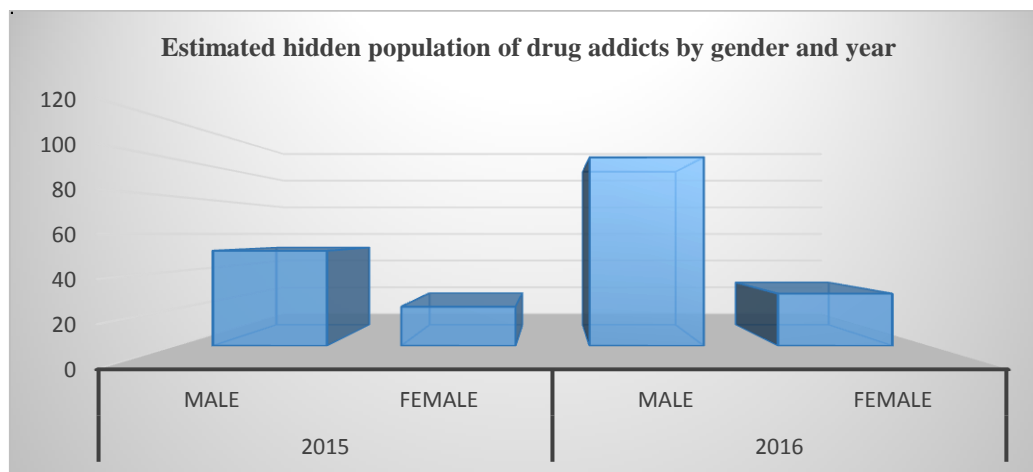


Fig 3.2

Table 3.3. Estimated Total population of drug addicts in Ekiti State between 2015 and 2016

| Population | Estimated total | S.e. | 95% CI for the total estimate |
|--------------|-----------------|-------------|-------------------------------|
| 2015 Male | 169 | 16.7 | (136 ,202) |
| Female | 73 | 10.7 | (52 ,94) |
| 2016 Male | 242 | 30.0 | (183,301) |
| Female | 74 | 15.2 | (44,104) |
| Total | 558 | 36.6 | (486,636) |

The Petersen Lincoln estimator produces an estimated total population of 558 with an approximated standard error of 36.6 and a 95% confidence interval of (486, 636).

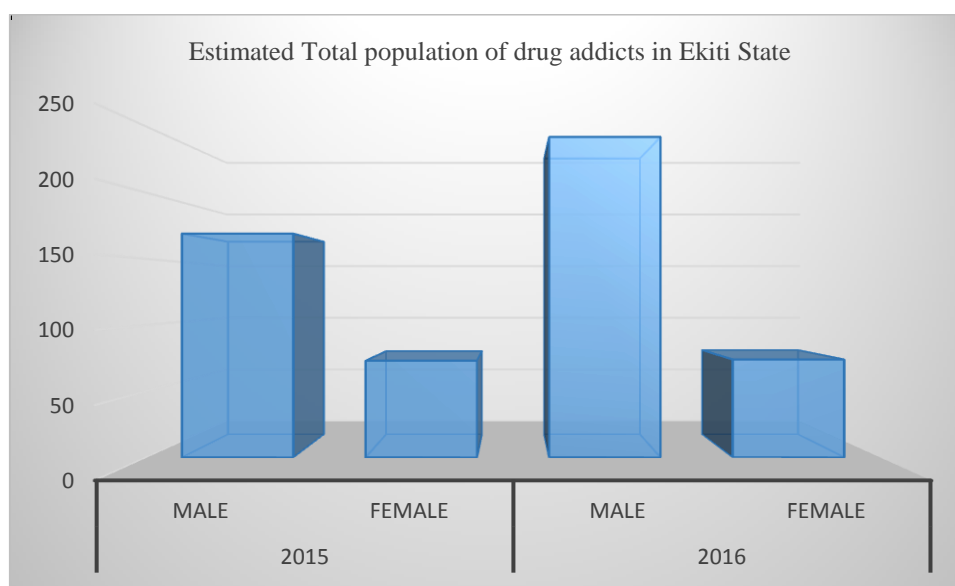


Fig 3.3

Summary and Discussion of Results

The study identified the hidden population of drug addicts in Ekiti State, Nigeria. Using capture recapture method. Two data sources used as independent lists are namely National Drug Law Enforcement Agency and EKSUTH Psychiatric unit data. Estimate were carried out for two-year period. For each year, we identified the numbers of males and females in both data sources separately.

In 2015, there were 57 males and 22 females recorded in the NDLEA list, 92 males and 43 females recorded in the psychiatric hospital list, 31 males and 13 females were recorded in both lists. Also in 2016, there were 61 males and 18 females recorded in the NDLEA list, 437 males and 18 females recorded in the psychiatric hospital

list, 27 males and 9 females were in both. The total number of addicts observed in the NDLEA and Psychiatric Hospital during the study period were 158 and 279 respectively. 80 were the matched number of addicts recorded in both lists. (Table 2). It is obvious that, there are more addicts recorded in EKSUTH psychiatric unit list than NDLEA list. This clearly show that there exist some hidden population of addicts. This point out the facts that the NDLEA are not effectively fighting the menace of drug addiction as more people take treatment and rehabilitation in hospital. Furthermore, the data in the table 2 revealed that male had the highest number of addicts during the study period. For the estimation of hidden population, the Petersen-Lincoln estimator yields an estimate of 201 (see table 2).

The identified addicts were missing in both NDLEA and psychiatric hospital records during the study period. These are addicts who do not want to be identified as addicts for the fear of arrest by NDLEA and that do not seek treatment in the hospital. For the estimation of total population, The Peterson Lincoln estimate is 558 with an approximated standard error of 37 and a 95% confidence interval of (486, 636).

Conclusion and Recommendation

The results of this study highlight the fact that the C-R technique is an efficient method for estimating the hidden population of drug addicts in any given region or community. This estimate will evidently assist health workers and NDLEA in curbing or controlling the advent of drug addiction among youths in Nigeria. It will also help people working in different sectors to develop a proposal for appropriate intervention. This method exposes the fact that there exist some hidden population of addicts. It also gave the exact hidden population of addicts from the two data sources. The knowledge of the number of hidden drug addicts within a population would assist health workers, NDLEA and relevant authorities to identify the exact estimate of hidden population of drug addicts in planning and controlling of the menace of drug addiction. It will also assist in capturing the exact regions or communities where drug abuse/addiction is prevalent for efficient planning of rehabilitation programs for the populace.

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