Female Adult Mortality in an Urban Settlement in South-West Nigeria

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Abstract

The lack of reliable demographic data from traditional sources, occasioned by deficient vital registration system and periodic censuses, makes indirect estimating of demographic indicators imperative in Nigeria. This study generated estimates of female adult mortality in Mokola, South-West Nigeria. This single round cross-sectional study adopted a two-stage cluster sampling procedure to select 994 women aged 15-49 years from households between November 2006 and February 2007. Information on mothers' survivorship was collected using a structured questionnaire while Timaeus' variant of Brass' Orphanhood method was adopted in generating estimates of female adult mortality. The proportion of respondents with mother alive reduced with increase in age of respondents. The adjusted female adult mortality level, summarized by the probability of dying between the ages of 15 and 60 years ($_{45}q_{15}$) was 33.2/1000. The study suggests the need in investing in research and surveillance systems to improve on the estimation of mortality levels in Nigeria**.**

Keywords: Female adult mortality, Survival, Indirect estimates, Brass' techniques.

BACKGROUND

The lack of reliable demographic data from conventional sources, occasioned by poor vital registration system and deficient periodic censuses, makes the development of indirect techniques for estimating demographic indicators of mortality imperative in Nigeria [1].

While the reliability of data from the vital registration system in Nigeria is seriously affected by the problems of under-registration and age misreporting [2]., geographical information given in the past Nigeria Demographic and Health Surveys is highly aggregated and may therefore conceal local and state-specific effects. Obviously there exists a state-specific geographical variation in the level of mortality in Nigeria. These variations may be attributable to differences in the physical and economic environment, which in turn influence exposure to diseases.

Given the paucity of vital-events registration and knowledge of health status of a population in most developing countries, demographic and health surveys using prospective multi-round surveys were introduced [3]. However due to the cost implication of such surveys, retrospective single round surveys were discovered to be more cost effective in providing data for health planning, practice, evaluation, and allocation of resources. Such surveys include collecting information on sibling histories that ask each respondent about the survival or otherwise of each sibling. A number of countries have sought to measure adult mortality by including questions in censuses and surveys concerning the survival or otherwise of each respondent's mother or father. Attempts have also been made to use the age distributions from successive censuses to arrive at measures of adult survival [3]. Estimates of mortality from such retrospective survivorship reports are classified as indirect techniques. The term "indirect" to qualify some of the techniques used in demographic estimation has its origin in the fact that such techniques produce estimates of a certain parameter on the basis of information that is only indirectly related to its value. It describes any estimation method that depends on models or uses consistency checks, or indeed uses conventional data in an unconventional way [4].

One common index of measuring the pace of mortality change is the life table survivorship from exact age 15 years to exact age 60 years ($_{45}p_{15}$) which can be interpreted as the probability of surviving to old age, subject to surviving childhood, at the prevailing level of mortality. This index, which is a complement of the probability of dying between exact age 15 and 60 ($_{45}q_{15}$), has been adopted as the preferred index of adult mortality [5]. Timæus (1993) points out that some of the results on adult mortality based on data that have been subjected to smoothing and adjustment have shown that, for example around 1980, more than 75 per cent of those aged 15 would survive to age 60 in Benin and The Gambia. In Ghana, Mauritania, and Zimbabwe, the equivalent figure is more than 80 per cent [6]. The increase from low to high mortality in some countries has been substantial. For example, Feeney (2001) reports that in Zimbabwe the value of $_{45}p_{15}$ decreased from about 80 per cent in 1982 to about 50 per cent in 1997 [7]. In Malawi, this value increased from 56 per cent in 1966 to 58 per cent in 1977 and further increased to 68 per cent in 1987 before declining to 52 per cent in 1998 [8,9].

In southern Africa, adult mortality levels in neighbouring countries quite often not only appear to be close but also have similar trends and patterns. In this region, adult mortality appears to have leveled off at high levels while that of children appear to have declined. Although much attention in the past has been paid to mortality and morbidity in adults and children living in the urban areas, little is known about the extent of mortality of adult populations in the rural areas of sub-Saharan Africa. Lack of such basic health data places health planners and policy makers at a disadvantage [10]. Adults, especially the economically active, provide the economic support for the whole population, and the emergence of the HIV/AIDS pandemic has increased the understanding of the effects of increased adult mortality and morbidity.

In 1995, a Lusaka study on adult mortality among young adults, death rates were 20 times higher than in another study in rural and urban Nigeria [11, 12]. The Lusaka study comprised poor urban neighbourhoods where a total of 2,258 households (representing 6,440 adults and 5,073 children) were initially interviewed in 1995 and followed up for two years. It was found that 29 per cent of all households reported one or more deaths within two years, a total of 392 adult deaths (202 men and 190 women). The crude death rate in Lusaka was 2.5 times higher than the Nigerian cohorts. The Nigerian study, conducted in 1995, followed 7 628 adults over the age of 15 years in an urban cohort of Ibadan and 4 205 adults over the age of 25 years in the nearby rural district of Igbo-Ora. A follow-up was done every three months to see if a death had occurred. The findings showed that a total of 216 deaths occurred during the follow-up [13].

In a study to measure mortality and probability of death between 15 and 59 years of age ($_{45}q_{15}$) in one urban and two rural areas of Tanzania, the result showed that Crude mortalities ranged from 6.1/1000/year for women in the rural settlement of Hai to 15.9/1000/year for men in the other rural settlement of Morogoro rural. The probability of death before age 60 ($_{45}q_{15}$) was 47% and 45% in Dar es Salaam; 37% and 26% in Hai; and 48% and 58% in Morogoro for males and women respectively [14].

Study objective

This study aimed at generating estimates of female adult mortality in Mokola, a densely populated urban settlement in South-West Nigeria, where no such estimates have been generated either from the grossly deficient vital registration system or the National Demographic and Health Surveys.

METHODS

This single round cross-sectional study adopted a two-stage cluster sampling procedure to select 964 women aged 15-49 years from households between November 2006 and February 2007. The study area, Mokola, is a densely populated (314 persons/Km^2) urban settlement in Ibadan, Oyo state, located in the south western region of Nigeria.

The first stage of sampling involved the selection of 30 clusters by simple systematic random sampling. The clusters were made up of already existing streets as evident in the cartographic representation of Mokola. In the second stage, men and women aged 15-49 years were selected from a listing of all individuals in the 30 clusters selected at the first stage. Retrospective information on mothers' survivorship was collected using a structured questionnaire.

Ethical Approval

Ethical clearance was obtained from the joint University of Ibadan /University College Hospital Institutional Review Committee. Informed consent for confidentiality was obtained from the participants before administering the questionnaires using the informed consent form. The participants were informed on their right to either take part in the study or decline. The questionnaire was administered in respondent's local language when the need to do so arose. Confidentiality of information collected was assured by making sure that the questionnaires are only accessible to the interviewers and the researcher.

Data Management and Analysis

Data entry and analysis was carried out using SPSS 12.0. Data collection and editing was done concurrently to clarify some outliers on the field. Data cleaning was done by running frequencies of all relevant variables to identify inaccurate entries and missing values. Descriptive statistics and cross tabulations were generated after data editing.

Estimation of Female Adult Mortality

Timaeus' variant of the Brass' Orphanhood method was adopted in generating the estimates of female adult mortality [15, 16].

Data Required for the Method

1. The proportion of respondents with a surviving mother in each five-year age group from *n* to *n* + 4. This proportion is denoted by *S*(*n*). The set of proportions S(*n*) can be calculated when any two of the following items are available:

(a) The number of respondents with mothers alive;

(b) The number of respondents with mothers dead;

(c) The total number of respondents whose mother's survival status is known. All respondents who did not know (or declare) their mother's survival status should be excluded from the calculation.

2. The number of births in a given year classified by five-year age group of mother. This information is needed to estimate *M,* the mean age of mothers at the birth of their children in the population being studied. The *M* to be estimated is not the mean age of fertility schedule (mean age of child bearing); it is rather the mean age of fertility schedule weighted by the age distribution of female population. It may be regarded as an estimate of the average age difference between mother and child in the population, thus being an indicator of the average age at which the target persons (parents) begins their exposure to the risk of dying.

Procedure

Step 1: Calculation of mean age at maternity. The mean age of mothers (fathers) at the birth of a group of children (normally those born in the year before the survey) is denoted by *M*. Let *i* denote the five-year age group in the reproductive life span of a woman and lets *B*(*i*) be the number of births during a particular period to women in age group *i*, then the mean age of mothers is:

$$M = \Sigma \alpha_{(\iota)} B_{(\iota)} / \Sigma B_{(\iota)}$$

Where $a_{(i)}$ is the mid-point of five year age group i.

Step 2: Calculation of weighting factors. For the value of *M* calculated above and for each value of *n*, the weighing factors, *W*(*n*), are tabulated in table 5.

Step 3: Calculation of survivorship probabilities. If the survivorship of mothers is being considered, the probabilities of surviving from age 25 to age 25 + *n* are calculated by using the equation:

$$l_f(25 + n) / l_f(25) = W(n)S(n - 5) + (1.0 - W(n))S(n)$$

where S(*n*) is the proportion of respondents aged from *n* to *n* + 4 with mothers alive at the time of the interview.

Step 4: Calculation of number of years before the survey to which the survivorship estimates refer. When female mortality in adulthood has a pattern similar to that described by the general standard, the number of years before the survey to which each estimate derived from maternal orphanhood data refers, denoted by $t_{(n)}$, can be estimated as:

$$t_{(n)} = n(1.0 - u_{(n)}) / 2.0$$

where $u_{(n)} = 0.3333 \ln ({}_{10}S_{n-5}) + Z(M + n) + 0.0037(27 - M)$

The value of Z(M + n) is obtained by linear interpolation of the standard function for calculating the time reference for indirect estimates of adult survivorship [17].

Limitations of the Method

- There is a likehood that mortality and fertility may not have been constant during the past before the survey date as assumed in the model used
- As the study area is an urban area attracting migrants, this group of people may constitute a special population with characteristics concerning orphanhood different from those of persons who did not migrate.
- As an area prone to high rate of migration with poor communication system, orphanhood information obtained may not be accurate in this setting
- If the mortality pattern in the study population is significantly different from those of model life tables, the estimates will be affected.

RESULTS

A total of 994 women of reproductive age participated in the study. The mean age of the respondents was 31 years (+ 8.8). Most of the respondents (90.0%) had at least secondary education. The proportion of respondents with mother alive reduced with increase in age of respondents. Table 1 shows the proportion of daughters with mothers alive. The proportion of respondents with mother alive reduced with increase in age of respondents. The youngest age group has the highest proportion with surviving mothers while the oldest age group has the lowest proportion. Respondents whose mortality status of their mothers was not known have been excluded in the calculation of proportion with surviving mother.

Table 1: Proportion of Daughters with Mothers Alive

Age group of respondent	Central age (n)	Mother alive	Mother dead	Proportion with mother alive
15 -19	20	66	4	0.9429
20 – 24	25	140	10	0.9333
25 – 29	30	215	21	0.9110
30 – 34	35	157	22	0.8771
35 – 39	40	132	21	0.8627
40 – 44	45	79	22	0.7822
45 – 49	50	67	28	0.7053

Table 2 shows the female adult survivorship probabilities (measured from age 25) from proportion of daughters with surviving mother respectively. M is fixed at 26 years (M is assumed to be in the region 25 and 27 years in the developing countries). The appropriate weights, *W*(n), were obtained from column 6 of table 5 in annex 1.

Table 2: Estimation of Female Adult Survivorship Probabilities from Proportion of Daughters with Surviving Mother

Central age (n)	Weighing factor W(n)	Proportion with mother surviving S(n – 5)	Complement of weighing factor (1 - W(n))	Proportion with mother surviving S(n)	Female adult survivorship probability *lf*(25 + n)/*lf*(25)
20	0.756	0.9429	0.244	0.9333	0.9405
25	0.809	0.9333	0.191	0.9110	0.9290
30	0.834	0.9110	0.166	0.8771	0.9054
35	0.844	0.8771	0.156	0.8627	0.8749
40	0.791	0.8627	0.209	0.7822	0.8459
45	0.708	0.7822	0.292	0.7053	0.7597
50	0.514	0.7053	0.486		

Table 3 shows the estimated and graduated values of the survivorship estimates. The values were obtained using Brass two-parameter logit model life table, α and β, estimated iteratively (table 7). The graduated values obtained reveal no significant difference from the estimated values. The adjusted female adult mortality level, summarized by the probability of dying between the ages of 15 and 60 years (${}_{45}q_{15}$) was 33.2/1000.

Table 3: Female Adult Survivorship Probabilities from Proportion of Daughters with Surviving Mother

Central age (N)	Estimated Female adult survivorship probability *lf*(25 + n)/*lf*(25)	Graduated Female adult survivorship probability *lf*(25 + n)/*lf*(25)
20	0.9405	0.9521
25	0.9290	0.9331
30	0.9054	0.9073
35	0.8749	0.8715
40	0.8459	0.8174
45	0.7597	0.7376

Tables 4 shows the estimation of time reference periods for which survivorship estimates obtained from above refer. The reference period of the survivorship estimates is 12.1 years to 8.7 years; this implies that the estimates obtained refer to mortality operating between January 1994 and July 1998.

Table 4: Estimation of Time Reference Periods for Survivorship Estimates Derived From Proportion of Daughters with Surviving Mothers

Central age (n)	Proportion with mother surviving $_{10}S_{(n-5)}$	Length of exposure indicator M + n	Standard function Z(M + n)	Correction function $u_{(n)}$	Reference period $t_{(n)}$	Year
20	0.9364	46	0.149	0.1308	8.69	1998.7
25	0.9197	51	0.205	0.1808	10.24	1996.2
30	0.8964	56	0.274	0.2412	11.38	1995.4
35	0.8705	61	0.356	0.3135	12.01	1994.0
40	0.8307	66	0.452	0.3939	12.12	1994.1
45	0.7449	71	0.568	0.4735	11.85	1994.9

DISCUSSION/CONCLUSION

The smoothing process reveals slight under reporting of mothers' death in age group 15 -19 years and over reporting at older ages. That the proportions of male respondents reporting mother alive is higher than the corresponding proportion of female respondents in this study is consistent with pattern observed in African countries [18]. This fact has been attributed to differential age misreporting as, males have a tendency to exaggerate their ages, and since the proportions with mother alive falls rapidly with increasing age of respondents, any exaggeration of reported ages would bias the proportions with living mothers upwards [18].

The data does not reflect the "adoption effect" as observed in some studies in Africa [15, 18-20].

The adjusted female adult mortality level, summarized by the probability of dying between the ages of 15 and 60 years ($_{45}q_{15}$) obtained in this study reflect an overall low adult mortality level in comparison with mortality at younger ages (estimated in this study) and 2000 WHO estimates [21]. The reference period of the female adult survivorship estimates obtained as 12.1 years to 8.7 years, implies that the estimates obtained refer to ones operating between January 1994 and July 1998. A comparative assessment of this data alongside similar data for other African countries estimated the probability of dying between ages 15 and 60 around 1995 at 23% and 17% for Cameroon and Benin, respectively [22]. These estimates are evidently on the high side compared to those presented in the current study, perhaps attributable to methodological or accessibility to health care differences.

These mortality levels seem slightly too low and might have resulted from the relatively small sample size; over-estimation of the previous mortality rates; improving child survival due to the proximity of the study area to a tertiary health institution and other health centers in the community.

The methodology adopted in the study presents plausible female adult mortality estimates in the study area.

The findings of this study suggest the need to invest in research and surveillance systems to improve on the estimation of mortality levels in Nigeria. Building monitoring capacity would facilitate better understanding of the number of people dying and from what cause, and to assess which interventions are making a difference. Also, questions on adult mortality should be incorporated in subsequent National Demographic and Health as observed in countries such as Cameroun, Malawi and Tanzania. This will serve as baseline estimates for adult mortality in Nigeria.

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Annex

Table 5: Weighing Factors, $W_{(N)}$, for Conversion of Proportion of Respondents with Mothers Alive into Survivorship Probabilities for Females

	Mean age M, for mothers at maternity								
Age (n)	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
10……..	0.420	0.470	0.517	0.557	0.596	0.634	0.674	0.717	0.758
15…….	0.418	0.489	0.556	0.618	0.678	0.738	0.800	0.863	0.924
20…….	0.404	0.500	0.590	0.673	0.756	0.838	0.921	1.004	1.085
25…….	0.366	0.485	0.598	0.704	0.809	0.913	1.016	1.118	1.218
30…….	0.303	0.445	0.580	0.708	0.834	0.957	1.080	1,203	1.323
35…….	0.241	0.401	0.554	0.701	0.844	0.986	1.128	1.270	1.412
40…….	0.125	0.299	0.467	0.630	0.791	0.950	1.111	1.274	1.442
45…….	0.007	0.186	0.361	0.535	0.708	0.884	1.063	1.250	1.447
50…….	-0.190	-0.017	0.158	0.334	0.514	0.699	0.890	1.095	1.318
55…….	-0.368	-0.220	-0.059	0.101	0.270	0.456	0.645	0.856	1.083
60…….	0.466	-0.352	-0.217	-0.084	0.053	0.220	0.378	0.579	0.800

Table 6: Values of the Standard Function for Calculation of the Time Reference for Indirect Estimates of Adult Mortality

Age	Standard function Z(x)	Age	Standard function Z(x)	Age	Standard function Z(x)	Age	Standard function Z(x)	Age	Standard function Z(x)
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
26	0.090	36	0.092	46	0.149	56	0.274	66	0,452
27	0.090	37	0.093	47	0.160	57	0.289	67	0.473
28	0.090	38	0.095	48	0.171	58	0.305	68	0.495
29	0.090	39	0.099	49	0.182	59	0.321	69	0.518
30	0.090	40	0.104	50	0.193	60	0.338	70	0.542
31	0.090	41	0.109	51	0.205	61	0.356	71	0.568
32	0.090	42	0.115	52	0.218	62	0.374	72	0.595
33	0.090	43	0.112	53	0.231	63	0.392	73	0.622
34	0.090	44	0.130	54	0.245	64	0.4411	74	0.650
35	0.091	45	0.139	55	0.259	65	0.431	75	0.678

Table 7: Estimated Smoothed Life Table for Females, Mokola, 2006

Age	African Standard	Logit system
x	***ls(x)***	***l*(x)***
0	-	1.0000
1	-0.9970	0.9704
2	-0.8052	0.9591
3	-0.7252	0.9533
5	-0.6515	0.9472
10	-0.5498	0.9373
15	-0.7362	0.9338
20	-0.4551	0.9273
25	-0.6826	0.9184
30	-0.3150	0.9091
35	-0.2496	0.8992
40	-0.1816	0.8880
45	-0.1073	0.8744
50	-0.0212	0.8570
55	0.0832	0.8333
60	0.2100	0.8004
65	0.3746	0.7507
70	0.5818	0.6774
75	0.8611	0.5636
80	1.2375	0.3991

$\alpha* = -0.877$, $\beta* = 0.870$, $l*_{(x)} = [1.0 + \exp(2\alpha + 2\beta\lambda s(x))]^{-1}$