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Diagnostic Tests on Assessing the Quality of Maternal Orphanhood Data from the 1996 South African Census and Implications for the Indirect Estimation of Adult Mortality

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Abstract

The maternal orphanhood technique is one of the oldest indirect demographic techniques used for the estimation of adult mortality in populations with inadequate vital statistics. One of the pioneers of the technique had cautioned for the careful assessment of the maternal orphanhood data. All researchers have not heeded this caution and as a result, improbable adult mortality estimates could not be adequately explained. In this paper, the maternal orphanhood data from the 1996 census have been subjected to a battery of diagnostic tests. The diagnostics attempted in the paper have shown that among the factors that affect the estimates of maternal orphanhood, the one with the least effect on the mortality estimates is age misreporting. The age analyses show very good age reporting for all population groups and all provinces. The next factor with less effect on the mortality estimates is that of 'adoption effect'. In this case it is hard to distinguish 'adoption effect' from 'AIDS orphans' effect. This adoption/AIDS orphans effect is more pronounced in Eastern Cape and Northern Cape. The two factors which show large effect in the trend in mortality estimates is the age distribution of maternal orphans and the proportion of those who do not know or did not state their maternal orphanhood status (DK and NS). The paper has shown that while the maternal orphanhood data is good, unique factors related to South African history have contributed to raising the proportion of DK and NS in the data. It is concluded that more research is needed on the role of the maternal orphanhood technique in an era of increasing deaths due to AIDS in some population subgroups and in cases of increasing ageing and low mortality in other population subgroups. It is hoped that the incomplete gamma function would be found useful in the modelling efforts in this direction.

Diagnostic tests on assessing the quality of maternal orphanhood data from the 1996 South African census and implications for the indirect estimation of adult mortality.

Introduction

Prior to 1991, South African official statistics relied solely on recorded deaths (and population denominators) for publishing life tables. Separate life tables were published for three out of four population groups namely; whites, Indians/Asians and coloureds. For Africans/blacks who comprised the majority of the population, vital statistics was poorly recorded and hence not much was known about the mortality of this population group. From 1991 till 1998, the population group variable was dropped from births and deaths notification forms and hence it was not possible to use vital statistics to obtain life tables for the different population groups. Instead, national household surveys such as the October Household Survey (OHS) started including questions on survivorship of kin in the questionnaires and this opened the way for using indirect techniques for obtaining life tables and other measures of fertility. In line with this trend, the 1996 population census of South Africa included questions on kin survivorship in its questionnaire. This paper forms part of a project whose broad aim is to construct life tables for South Africa using indirect estimation techniques. As part of this project, infant, childhood and adult mortality estimates have to be obtained and appropriately combined (if the estimates are realistic) to obtain life tables. This paper specifically deals with only one part of the project, namely assessing the quality of the female adult mortality data.

Questions on survivorship status of respondents' mothers (maternal orphanhood) have been asked since the 1960s round of censuses and have been included in the WFS and DHS round of surveys. Data from these questions are used in estimating female adult mortality through the maternal orphanhood techniques. The techniques have been widely tested under different settings and have been found to give a good indication of the level of the adult mortality. However, according to Hill (1984), the values of the maternal orphanhood procedures depend on the reliability of the data which can be assessed in terms of internal consistency, consistency with independent estimates and replicability. A more careful assessment of the maternal orphanhood data is therefore warranted.

Since respondents are asked about their ages (dates of birth) and about the survivorship status of their mothers, the data collected could be affected by the following factors

1. Age mis-reporting of respondents
2. Misreporting of orphanhood status (largely through the substitution of foster parents for biological parents, a phenomenon known as the 'adoption effect;)
3. Multiple reporting maternal orphanhood status for women with many surviving children.
4. Non-reporting of maternal orphanhood status (through "don't know" and "not stated)
5. Selectivity of respondents.

At the computation stage, the adult mortality estimates are affected by the following factors:

1. Error is estimating the mean age at maternity ('M')
2. Inappropriate choice of reference life table (Hill and Trussel.1977)

Ewbank (1981) discussed at the length about the effect of age misreporting on the parental survival technique for estimating mortality. He did a simulation exercise to demonstrate the effect that age exaggeration has on estimated life expectancy. The results showed that age exagerration of approximately 2.5 years will bias the estimated of life expectancy upward by approximately the same amount. Later, Blacker and Gapere (1988) have discussed how most of the other errors biased the estimates obtained through the maternal orphanhood method. One of the factors however which they did not discuss was the impact on adult mortality estimates, of large proportions of respondents who do not know or do not state their maternal orphanhood status. This factor was mentioned briefly by United Nations (1983) is their discussion of the maternal orphanhood data of Bolivia. In that example, the numbers of respondent of unknown maternal orphanhood status was little and hence were ignored in the computations. As a cautionary note, the following remarks were added: 'However, because greater levels of non-response may occur, it is important to exclude the non-responses when calculating the proportions with surviving mother' (United Nations, 1983:105).

The aim of this paper is to assess the quality of the responses to this question and explore the implications for the indirect estimation of maternal mortality.

Methods and material

The data used for preparing this paper comes from the full 1996 census weighted data. Only one outcome variable is analysed, namely, the response to the question on maternal orphanhod status. In the 1996 census, the question asked on maternal orphanhood was phrased as follows: "Is (the person's) own mother still alive?". The pre-coded responses given on the questionnaire were: 1= Yes.2= No and 3= Don't Know. During the coding stage, two additional codes were assigned as follows: 4= Unspecified (Not Stated) and 5= Not applicable (Institutional).

Several background variables (serving as levels of disaggregation) were included at different stages in the analyses. These variables include gender, population group (Africans/Blacks, couloureds, Indians/Asians and whites), reported ages (singly and in five-year age groupings), province of residence (Gauteng, Mpumalanga, North West, KwaZulu-Natal, Northern Cape, Eastern Cape, Western Cape, Free State and Northern Province) and urban/non-urban location.

Three sets of diagnostics were attempted: diagnostics on age misreporting, diagnostics on reporting of maternal orphanhood status and diagnostics on estimation of female adult mortality.

1. Diagnostics on age-misreporting

Three standard demographic methods were used: graphical display of the age distribution in single years, analysis of digit preference and age and sex ratio analysis. The last three methods are further described below.

Analysis of digit preference

Two standard indices used for this purpose are the Whipple's and Myer's indices. Whipple's index assumes uniform distribution of population in a five-year range and aims to detect heaping on terminal digits '0' and '5' in the range 23 to 62 years. Theoretically, the index varies between 100, representing no preference for '0' or '5' and 500, indicating that only age ending in '0' and '5' were reported. It must be noted that, Whipple's index has several limitations one of which is the assumption of uniform distribution of the population. This assumption might not always hold and as a result, computed Whipple's index could be less than 100.

The Myers' index was developed to detect preference for all terminal digits from 0 to 9. The method yields an index of reference for each terminal digit as well as a summary index of preference for terminal digits. The theoretical range of Myers' index is from 0 to 90. An index of 0 represents no heaping and an index of 90 represents a heaping of all reported ages at a single digit, say five (Shryock, Siegel et al., 1976)

Age and sex ratio analysis

Other standard indices of age accuracy (of group data) used are age and sex ratios and their derivative scores; the age ratio score, the sex ratio scores and the joint score or age-sex accuracy index. The joint score is the more commonly used summary index of overall age accuracy, taking into account sex distribution. The rationale for the joint score is that the age ratio should not deviate much from 100 assuming no age misreporting. An age data with joint score of less than 20 is considered accurate, one of score between 20 and 40 is inaccurate while one of score more than 40 is considered highly inaccurate (Shryock, Siegel et al., 1976).

While these scores do not measure digit preference by themselves, they can be used to detect enlargement or reduction in age groups that results either from transfers form one age group to another or from other causes.

2. Diagnostics on reporting of maternal orphanhood status

In the diagnostics of the reporting of maternal orphanhood status, proportions within age groups and age distributions of maternal orphanhood status were computed with the aim of detecting apparent errors in the data. It is known for example, the 'adoption effect' could be detected by the presence of unrealistically high proportion of young respondents with surviving mother (Hill, 1984).

Two sets of simple measures were computed:

1. $P(i,j) = N_{i,j} / N_{i.}$ (i=1.2..15;j=1.2..5)

2. $D(i,j) = N_{i,j} / N_{.j}$ (i=1.2..15;j=1.2..5)

where i refers to age group and j refers to categories of the maternal orphanhood question (with j=2 referring to maternal orphans) and N refers to the numbers in those categories.

The distributions of these measures with age are graphically illustrated and appropriate measures of central tendency were computed to assist in comparing the distributions.

3. Diagnostics on estimates of female adult mortality.

Hill (1984: 170) described the basis of the maternal orphanhood method in the following simple terms:

“If one considers survivorship of mother, the mothers of a group of respondents of age x are known to have been alive at the time of the births. Hence the proportion of respondents with a surviving mother represents the probability of those mothers surviving for x years. If it is assumed that the respondents are typical of all births x years earlier (as far as maternal survival is concerned), and that their mothers were typical in terms of survival of all women of those ages, the proportion with a surviving mother becomes an estimate of female adult mortality.”

For the technical computation, Hill (1984:170-171) simplifies further,

“Such a proportion cannot, however, be used directly, since the age distribution of the mothers affects the proportion: a given proportion surviving for relatively young mothers implies higher mortality than the same proportion for older mothers. Brass used models to relate survivorship ratios of the type *l*(A+B)/*l*(B), where A was related to the age of the respondent and B to the average age of mothers of children born in a particular time period, to calculate proportions with surviving mothers for different age locations of fertility and a single mortality function. A measure of age location of childbearing, an age distribution weighted mean of the age-specific fertility schedule, is used to select a suitable set of conversion factors for deriving survivorship ratios from observed proportions with surviving mother.’

More formally, the orphanhood method is based on the projection of some past population forward to the present. This is expressed as:

$$\int_0^\infty N(a,x)P(x)dx = S(a)$$

where N(a,x) refers to the number of children now aged *a* whose mothers bore them at age *x*, P(a) refers to the conditional probability of survival from age *x* to age *x+a* and S(a) is the number of surviving women to children now aged *a*.
The assumptions of the orphanhood method are as follows:

1) Mortality has remained constant in the recent past. The violation of this assumption has been overcome in the use of time reference.
2) There is absence of 'adoption effect'.
3) There is no interaction between parent's mortality and child mortality.

While there are different variants of the maternal orphanhood technique, the original Brass (1973) version has been used here. The method is based on an equation which relates the female probability of survival from age 25 to age 25+*n* to proportions of respondents in 2 contiguous 5 year age groups whose mother was still alive at the time of interview (not orphaned).

This equation is given as:

$$l_f(25+n)/l_f(25) = W(n)S(n-5)+(1-W(n))S(n)$$

Where S(n)= proportions of respondents aged from *n* to *n+4* with mother alive (not orphaned).

W(n) are weighting factors estimated using data from the Brass African standard and information on *M* (the mean age of fertility schedule weighted by the age distribution).

M is defined as:

$$M = \sum_{i=1}^{7} a(i)B(i) / \sum_{i=1}^{7} B(i)$$

B(i) represents births during a particular period e.g. 1 year.

The number of years before the survey to which the estimate refers is:

t(n)= n(1-u(n))/2

where u(n) is defined as:

$$u(n) = .3333\ln({}_{10}S_{n-5}) + Z(M+n) + .0037(27-M)$$

Z(M+n) is obtained by interpolation from standard table. ${}_{10}S_{n-5}$ is the proportion of respondents in the age group form *n-5* to *n+4* with mother alive and *n* is the mid point of the 10 year age group being considered (United Nations, 1983).

Conditional probability estimates for different ages were converted to one conditional probability estimate at one fixed pair of ages and the trends of the estimates were regressed on time to obtain estimates of slope and intercept. These measures could be for obtaining estimates of conditional probability at the different dates (within a limited period)

Results

1. Results of diagnostics on age-misreporting

The census age distribution in single years is given in Figure 1 for the RSA, Figure 2 for the four population groups and Figures 3 through 5 for the nine provinces. Among the population groups, only the age distribution of Africans/Blacks show some effect of digit preference. As Africans/blacks comprise the majority of South African population, the age distribution of the RSA show similar effect. Among the different provinces, the effect of digit preference is not very strong and the ages more affected are the middle and older ages rather than the younger ages. Table 1 shows that Whipple's indices for the RSA are very low for all the population groups. Most of the values obtained were close to 100. This suggests absence of preference for ages ending in '0' or '5' within the age range 23 to 62. Similarly, the values obtained for Myers' index were very low suggesting lack of digit preference. The lowest values of Myers' index obtained were those for whites followed by those obtained for coloureds and then by Asians/Indians. Joint scores were less than 20 for whites, coloureds and Indians/Asians but over 20 for Africans/blacks.

For all the provinces, Whipple's as well as Myers' indices were all very low. Joint scores were less than 20 for Western Cape, and Northern Cape and between 20 and 40 for the rest of the provinces.

Fig 1: The 1996 census age distribution in single years, RSA

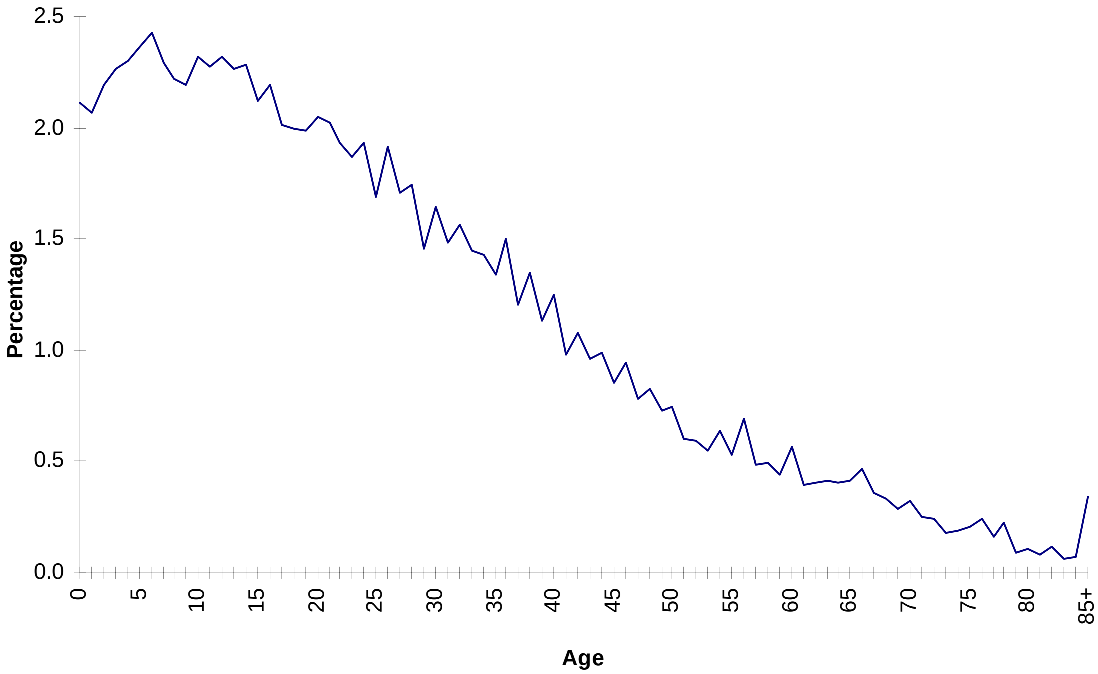


Fig 2: The 1996 census age distribution in single years by population group, RSA

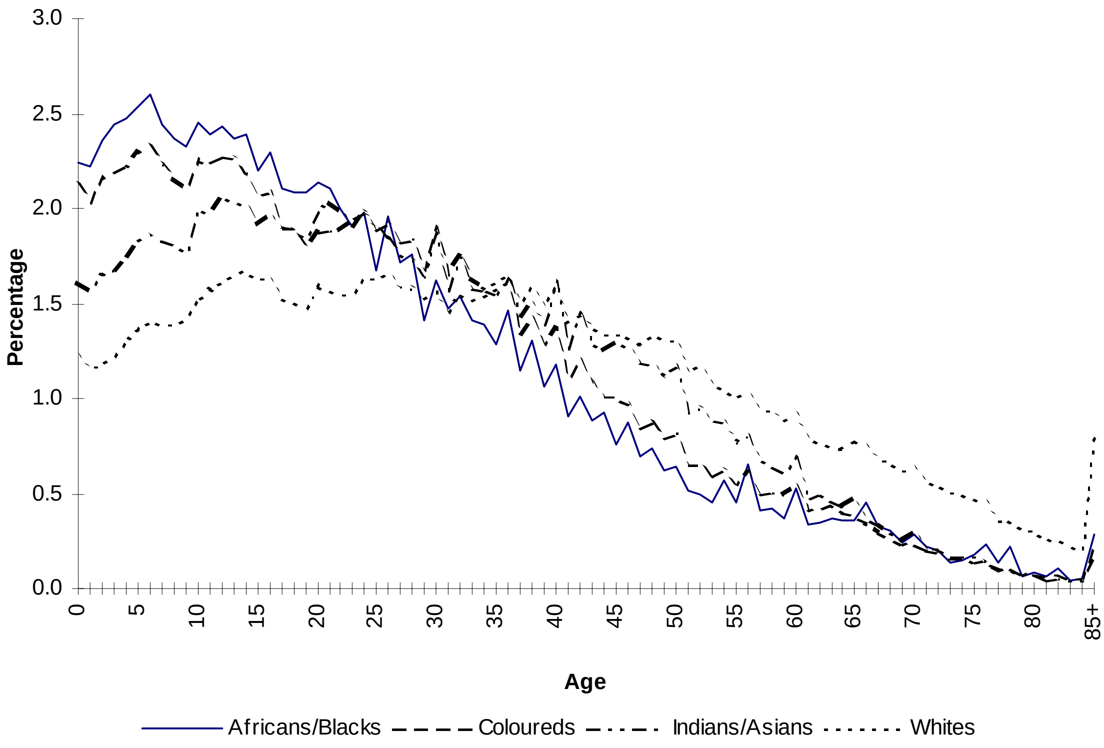


Fig 3: The 1996 census age distribution in single years, Eastern Cape, Western Cape and Northern Cape

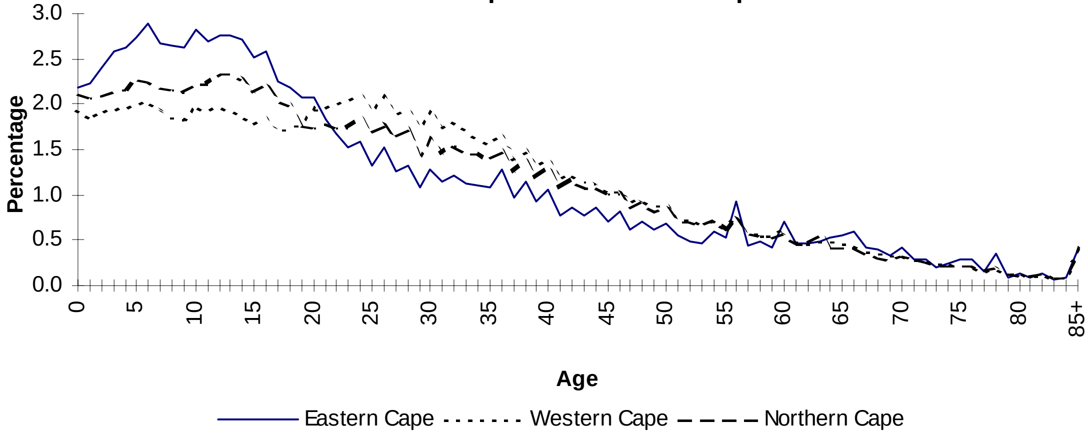


Fig 4: The 1996 census age distribution in single years, Free State, KwaZulu-Natal and North West

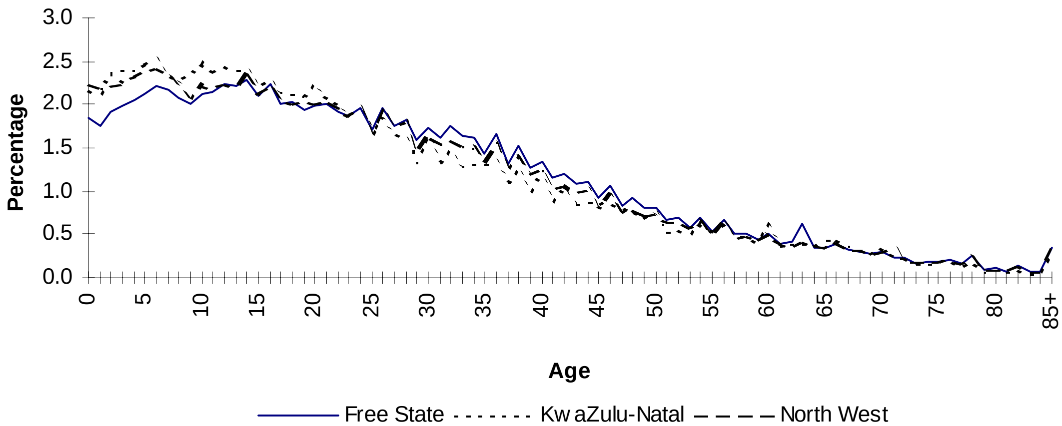


Fig 5: The 1996 census age distribution in single years, Gauteng, Mpumalanga and Northern Province

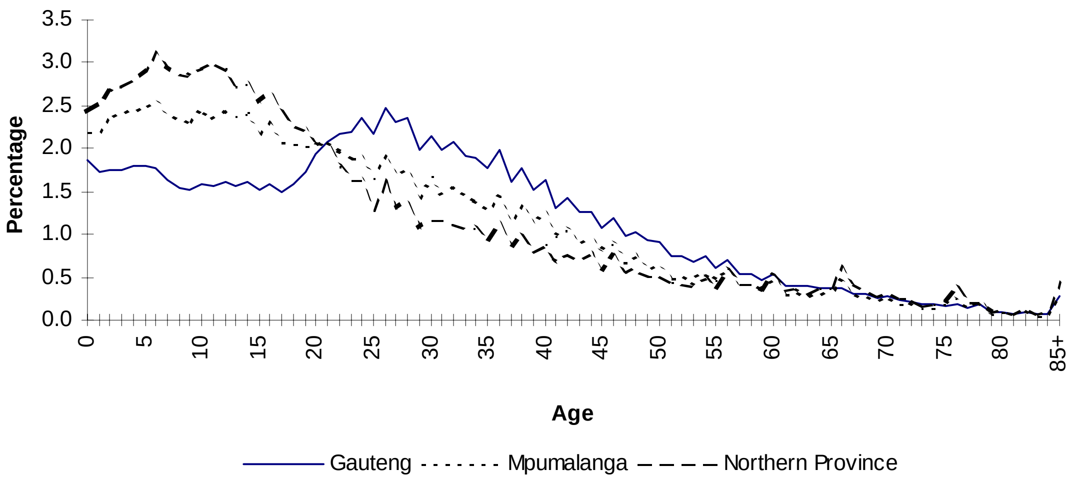


Table 1: Results of Whipple's and Myers Indices and Joint Scores for RSA, Population Groups and provinces

	Whipple's Index		Myer's Index		Age ratio score		Sex ratio score	Joint score
	Males	Females	Males	Females	Males	Females		
RSA	100.28	100.69	2.10	2.32	5.04	5.48	3.58	21.27
Population Group								
African/Black	97.39	98.03	2.50	2.34	8.31	6.77	6.04	33.18
Coloured	103.53	103.71	1.44	1.64	3.81	4.69	2.95	17.34
Indian/Asian	105.01	106.73	1.54	1.67	4.32	4.12	2.69	16.50
White	102.52	102.50	1.17	1.33	2.83	2.65	3.09	14.76
Province								
Eastern Cape	100.50	103.16	3.09	3.66	9.00	8.01	5.03	32.09
Western Cape	101.05	101.55	1.45	1.56	3.83	3.47	2.66	15.28
Northern Cape	101.81	101.10	1.72	1.83	2.24	3.15	2.96	14.26
Free State	97.59	97.46	2.07	2.35	4.56	6.12	5.80	28.08
KwaZulu-Natal	105.19	105.18	2.07	2.33	5.91	5.92	4.42	25.09
North West	97.44	96.63	2.09	1.91	3.57	2.86	4.86	21.01
Gauteng	99.14	99.75	2.07	1.94	5.60	4.36	4.91	24.69
Mpumalanga	100.79	99.53	2.22	2.47	7.27	9.34	5.61	33.44
Northern Province	95.77	95.20	2.43	2.82	11.36	10.22	5.68	38.62

2. Results of diagnostics on reporting of maternal orphanhood status

Distribution of responses to the question on maternal orphanhood.

Table 2 gives the breakdown of the respondents according to the responses given to the question on maternal orphanhood status. For RSA as a whole, the Table shows that the question was well answered. Of all the respondents, more than 96.0% responded to the question reporting that their mothers were either dead or still alive. Those who did not know or did not specify their maternal orphanhood status amounted to less than 2.0% while those for whom the question was not applicable amounted to 1.81%. Among the population groups, the one with the highest proportion of respondents whose mothers were still alive during the census was Africans/blacks (78.5%) followed by coloureds (75.1%). Whites reported the lowest proportion of respondents with mothers alive (68.1%). This distribution probably reflects the degree of ageing in the different population groups. As whites are the most aged population, it is expected that they should have the highest proportion of respondents reporting that their mothers were dead. On the contrary, as Africans/blacks make up a relatively younger distribution, relatively more African/black respondent would be expected to report that their mothers were still alive.

Table 2: Summary of proportion of maternal orphanhood status, RSA, population group and province, 1996

	Total						Proportions (%)				
	Mother alive	Mother dead	Don't know	Unsp.	NA: Institution	Total	Mother alive	Mother dead	Don't know	Unsp.	NA: Institution
RSA	30821376	7993929	188224	364081	725769	40093379	76.87	19.94	0.47	0.91	1.81
Population group											
Africans/Blacks	24137556	5725974	162183	281894	455869	30763476	78.46	18.61	0.53	0.92	1.48
Coloureds	2681838	778878	11307	18027	81999	3572048	75.08	21.80	0.32	0.50	2.30
Indians/Asians	772107	248571	1589	5052	9006	1036325	74.50	23.99	0.15	0.49	0.87
Whites	2973860	1182887	11215	32452	168844	4369258	68.06	27.07	0.26	0.74	3.86
Unspecified	256016	57619	1931	26655	10051	352272	72.68	16.36	0.55	7.57	2.85
Total	30821376	7993929	188224	364081	725769	40093379	76.87	19.94	0.47	0.91	1.81
Provinces											
Eastern Cape	4746277	1355525	10956	39437	99031	6251226	75.93	21.68	0.18	0.63	1.58
Western Cape	2886832	884821	11854	22283	109308	3915098	73.74	22.60	0.30	0.57	2.79
Northern Cape	606315	190188	3377	4457	26769	831107	72.95	22.88	0.41	0.54	3.22
Free State	1971361	552582	12135	14399	53869	2604346	75.70	21.22	0.47	0.55	2.07
KwaZulu-Natal	6419309	1642875	33253	78676	124396	8298509	77.35	19.80	0.40	0.95	1.50
North West	2598568	636750	10071	23149	58489	3327027	78.10	19.14	0.30	0.70	1.76
Gauteng	5388931	1523817	75021	100870	159755	7248394	74.35	21.02	1.03	1.39	2.20
Mpumalanga	2197931	483318	13224	28412	28599	2751485	79.88	17.57	0.48	1.03	1.04
Northern Province	4005853	724052	18334	52396	65552	4866187	82.32	14.88	0.38	1.08	1.35
Total	30821376	7993929	188224	364081	725769	40093379	76.87	19.94	0.47	0.91	1.81

Proportion of maternal orphans out of all respondents in given age groups

Table 3 gives the proportion of maternal orphans out of all respondents in a given age group, P(i.2). One would expect that as the ages of the respondents increase, the proportion of respondents reporting that their mothers were dead would correspondingly increase. The values in Table 3 reflect this expectation. For further clarity, the proportions of maternal orphans and those of non-maternal orphans out of all respondents in given ages groups are shown in Figures 6a and 6b respectively, for the RSA, Figures 7a and 7b for the population groups and in Figures 8a through 10b for all the provinces. Since the two pains of graphs are largely complementary, it would suffice to describe one set of graphs, namely those dealing with maternal orphans. Figure 6a shows a sinusoidal curve with low rise at the younger ages below 20, a fairly steep rise over the adult ages and a tapering off after age 65. All the population groups and all the provinces exhibit this general shape. In the case of the population groups, Figure 7a shows crossovers occurring at various ages. One crossover occurs at about 30-34 between Indians/Asians and Africans/Blacks; another occurs at about 40-44 between Indians/Asians and coloureds and another crossover occurs at about 55-59, between whites and Africans. At the highest age group 70-74, a near convergence occurs between whites, coloureds and Asians/Indians. For a large section of ages, up to age 60, the population group with the lowest proportion of maternal orphans were whites. For ages above 40, the population group with the highest proportion of maternal orphans was Indians/Asians followed by coloureds. For ages below 20, it was Africans/Blacks who had the highest proportion orphaned among all the population groups.

For the provinces, the shape of the curves are very similar the difference being mostly in the levels of the curves. Among the provinces, the one with the highest proportion of mothers alive was for Northern Province (82.3%) followed by Mpumalanga (79.8%) while the lowest reported proportions were for Northern Cape (73.0%), Western Cape (73.7%) and Gauteng (74.4%). With the exception of Northern Cape, this distribution reflects the degree of urbanisation in the provinces. More urbanised provinces are more likely to have older populations than less urbanised provinces. Consequently, one would expect higher proportions with mothers dead in the more urbanised provinces.

Table 3: Summary of proportion of maternal orphans out of all respondents in a given age group, RSA, population group, Province, 1996

Age group	RSA	African/ Black	Coloured	Indian/ Asian	White	E.C.	W.C.	N.C.	F.S.	KZN	N.W.	GT	MP	N.P
0-4	0.01242	0.01330	0.00922	0.00718	0.00643	0.01419	0.00808	0.01054	0.01283	0.01442	0.01142	0.01067	0.01217	0.01245
5-9	0.01973	0.02107	0.01735	0.01057	0.00924	0.02252	0.01361	0.02154	0.02117	0.02246	0.01982	0.01673	0.01857	0.01810
10-14	0.02872	0.03062	0.02827	0.01502	0.01337	0.03350	0.02245	0.03541	0.03214	0.03070	0.02886	0.02521	0.02723	0.02465
15-19	0.04525	0.04809	0.04739	0.02704	0.02097	0.05125	0.03829	0.05397	0.05025	0.04737	0.04590	0.04182	0.04439	0.03858
20-24	0.07747	0.08136	0.08796	0.05361	0.04013	0.08688	0.07370	0.09856	0.08465	0.07947	0.07868	0.07501	0.07725	0.06162
25-29	0.12649	0.13260	0.14462	0.10269	0.07136	0.14641	0.12441	0.14772	0.13967	0.13190	0.12533	0.11994	0.12581	0.09690
30-34	0.19251	0.19979	0.22434	0.18852	0.11707	0.22744	0.19555	0.21733	0.20629	0.20052	0.18501	0.18049	0.18788	0.15081
35-39	0.26936	0.27799	0.31353	0.29502	0.18396	0.32214	0.27606	0.29870	0.28093	0.28393	0.25564	0.24875	0.25618	0.21507
40-44	0.36787	0.37597	0.42443	0.42678	0.28082	0.43451	0.38199	0.39711	0.37321	0.39020	0.34668	0.33983	0.34904	0.30165
45-49	0.47654	0.48010	0.54739	0.55958	0.40748	0.55165	0.50209	0.51426	0.47656	0.50416	0.44608	0.44038	0.45052	0.39929
50-54	0.59469	0.59102	0.67264	0.68690	0.55340	0.66397	0.63097	0.63041	0.58777	0.62691	0.56061	0.56111	0.56231	0.50022
55-59	0.70250	0.69193	0.77127	0.78505	0.69447	0.76565	0.74571	0.73516	0.69486	0.72613	0.66550	0.67270	0.66254	0.61046
60-64	0.80108	0.78670	0.84771	0.86423	0.82119	0.84779	0.84132	0.83425	0.79701	0.81644	0.77439	0.78755	0.75592	0.70797
65-69	0.85591	0.84233	0.88878	0.90223	0.88697	0.89186	0.89349	0.88486	0.86256	0.86063	0.84690	0.85705	0.81883	0.78054
70-74	0.88481	0.87723	0.90370	0.91204	0.89902	0.91061	0.90224	0.90775	0.89608	0.88738	0.89040	0.88165	0.85366	0.82769

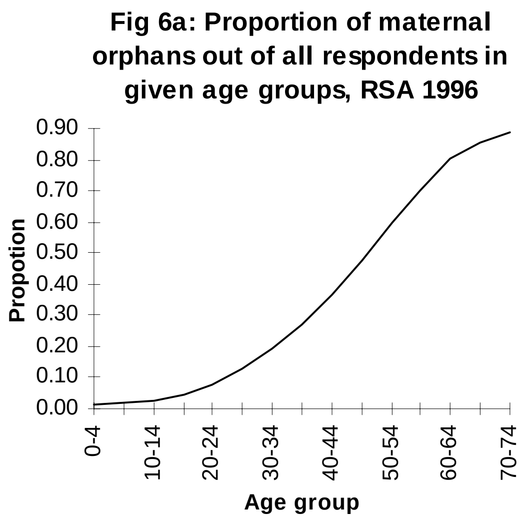


Fig 6a: Proportion of maternal orphans out of all respondents in given age groups, RSA 1996
Propotion
Age group
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74

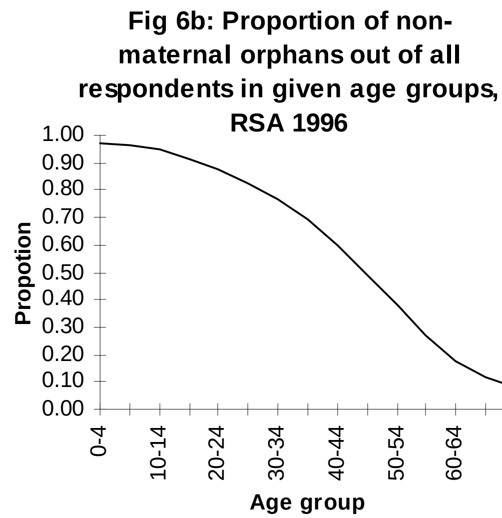


Fig 6b: Proportion of non-maternal orphans out of all respondents in given age groups, RSA 1996
Propotion
Age group
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74

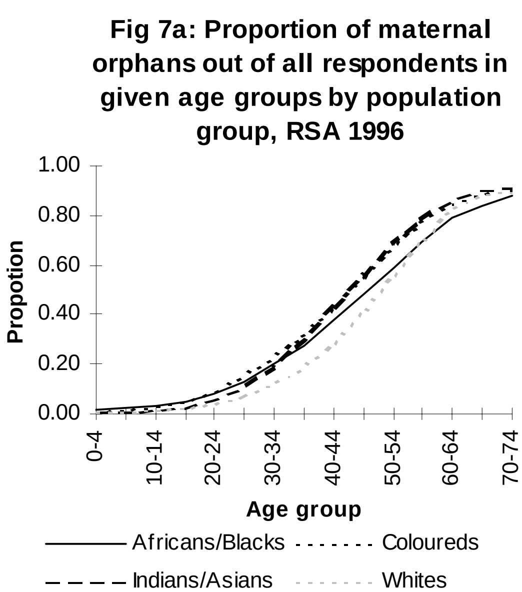


Fig 7a: Proportion of maternal orphans out of all respondents in given age groups by population group, RSA 1996
Propotion
Age group
0.00
0.20
0.40
0.60
0.80
1.00
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74
Africans/Blacks
Coloureds
Indians/Asians
Whites

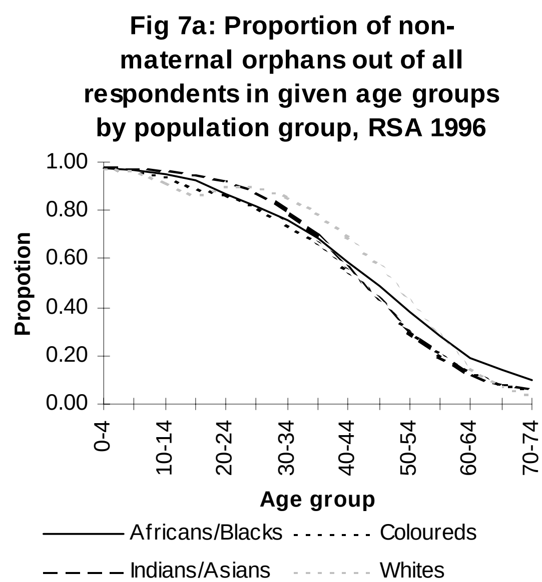


Fig 7a: Proportion of non-maternal orphans out of all respondents in given age groups by population group, RSA 1996
Propotion
Age group
0.00
0.20
0.40
0.60
0.80
1.00
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74
Africans/Blacks
Coloureds
Indians/Asians
Whites

Fig 8a: Proportion of maternal orphans out of all respondents in given age groups, Eastern Cape, Western Cape and Northern Cape, 1996

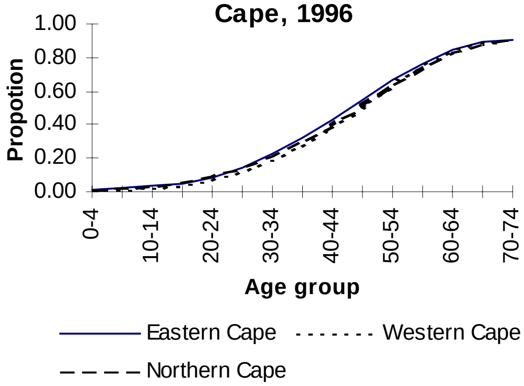


Fig 8b: Proportion of non-maternal orphans out of all respondents in given age groups, Eastern Cape, Western Cape and Northern Cape, 1996

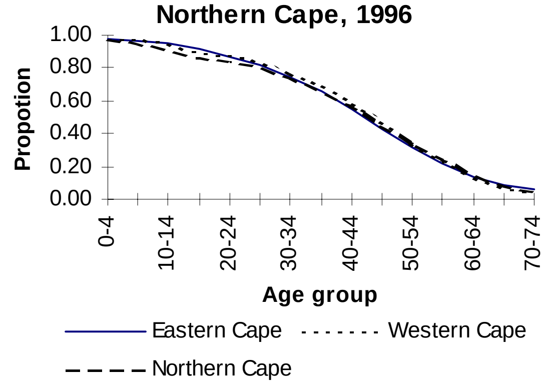


Fig 9a: Proportion of maternal orphans out of all respondents in given age groups, Free State, KwaZulu-Natal and North West, 1996

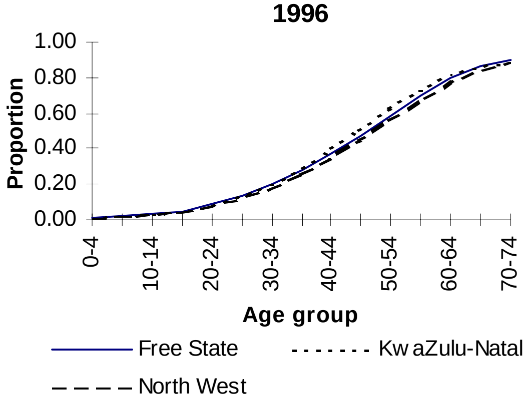


Fig 9b: Proportion of non-maternal orphans out of all respondents in given age groups, Free State, KwaZulu-Natal and North West, 1996

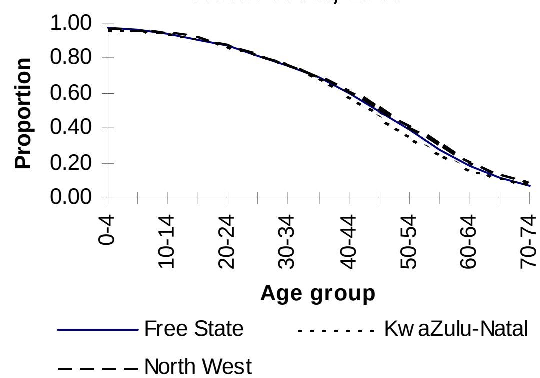


Fig 10a: Proportion of maternal orphans out of all respondents in given age groups, Gauteng, Mpumalanga and Northern Province, 1996

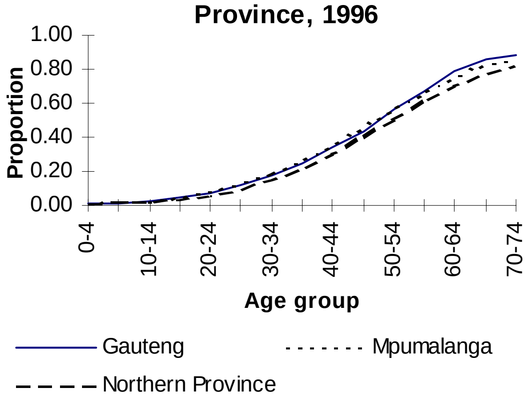
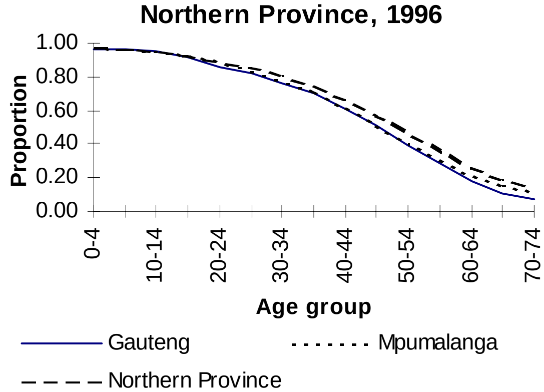


Fig 10b: Proportion of non-maternal orphans out of all respondents in given age groups, Gauteng, Mpumalanga and Northern Province, 1996



Age distribution of maternal orphans

Table 4 gives the age distribution of maternal orphans, D(i.2), for RSA, the population groups and the provinces. The figures show mostly uni-modal distributions and for this reason, a measure of peakedness (kurtosis), and a measure of the degree of asymmetry of a distribution around its mean (skewness) have been computed are shown in Table 4. For further clarity, the D(i.2) values are graphically shown in Figure 11 for the RSA, Figure 12 for the population groups and in Figures 13 through 15 for all the provinces. Figure 12 partly reflects the age structure of the different population groups. Only the distributions of whites and Indians/Asians show positive skewness towards the right. As Indian/Asians and whites are more aged populations, there are more survivors in the older ages reporting that they were maternal orphans. The age distribution of coloureds and Africans/blacks are similar, both are negatively skewed towards the left (with Africans/Blacks being more so). They both show lesser proportions of older maternal orphans compared to whites and Indians/Asians. In terms of measures of skewness, the absolute values of the skewness are higher for Africans/blacks and coloureds than for Indians/Asians and whites. Africans/blacks and coloureds correspondingly show higher proportions of younger maternal orphans compared to whites and Indians/Asians. Compared to the normal distributions, these distributions are all relavtively flat as shown by the negative kurtosis values.

Among the provinces, a few of the distributions of the D(i.2) were asymmetrically skewed to the right, towards the younger ages. The most skewed of such distributions is that of Eastern Cape. Correspondingly, the absolute value of its skewness is the highest of all the measures obtained.

Table 4: Summary of age distribution of maternal orphans for RSA, population group and porovince

Age group	RSA	African/ Black	Coloured	Indian/ Asian	White	E.C.	W.C.	N.C.	F.S.	KZN	N.W.	GT	MP	N.P
0-4	0.00745	0.00913	0.00478	0.00258	0.00166	0.00868	0.00370	0.00530	0.00628	0.00904	0.00733	0.00485	0.00889	0.01259
5-9	0.01244	0.01512	0.00933	0.00420	0.00273	0.01553	0.00626	0.01125	0.01153	0.01469	0.01304	0.00706	0.01407	0.02051
10-14	0.01805	0.02156	0.01533	0.00661	0.00454	0.02336	0.01037	0.01916	0.01816	0.02033	0.01855	0.01022	0.02053	0.02728
15-19	0.02555	0.03028	0.02234	0.01123	0.00691	0.03027	0.01617	0.02603	0.02655	0.02817	0.02745	0.01693	0.02964	0.03606
20-24	0.04167	0.04821	0.04070	0.02309	0.01339	0.03840	0.03530	0.04144	0.04252	0.04403	0.04451	0.04127	0.04827	0.04362
25-29	0.05904	0.06613	0.06379	0.03985	0.02408	0.04832	0.05674	0.05772	0.06326	0.05873	0.06196	0.06929	0.06660	0.04953
30-34	0.07993	0.08702	0.09248	0.06850	0.03780	0.06778	0.08219	0.07739	0.08832	0.07701	0.08251	0.09235	0.08879	0.06510
35-39	0.09654	0.10184	0.10931	0.09758	0.06056	0.08821	0.09767	0.09472	0.10401	0.09320	0.09890	0.11028	0.10114	0.07757
40-44	0.10625	0.10778	0.11830	0.12828	0.08508	0.09578	0.11050	0.10776	0.11266	0.10376	0.10647	0.11953	0.11201	0.08749
45-49	0.10797	0.10350	0.11831	0.14767	0.11409	0.09713	0.11607	0.11299	0.11147	0.11079	0.10318	0.11723	0.10637	0.09215
50-54	0.10191	0.09276	0.10819	0.14402	0.13425	0.09386	0.11250	0.10973	0.10401	0.10146	0.10440	0.10969	0.09475	0.08629
55-59	0.10151	0.09312	0.09931	0.12012	0.14130	0.10871	0.10931	0.10500	0.09403	0.10046	0.09696	0.09891	0.09289	0.10103
60-64	0.09635	0.08896	0.09096	0.09627	0.13765	0.11340	0.10108	0.09907	0.09289	0.09475	0.09111	0.08422	0.08163	0.10530
65-69	0.08772	0.08312	0.06570	0.06818	0.13164	0.10461	0.08364	0.07617	0.07365	0.08854	0.08137	0.06963	0.08302	0.12251
70-74	0.05762	0.05147	0.04118	0.04181	0.10431	0.06595	0.05849	0.05626	0.05066	0.05503	0.06225	0.04854	0.05139	0.07296
Kurtosis	-1.47909	-1.32987	-1.58636	-1.46825	-1.86363	-1.51893	-1.55912	-1.44017	-1.44688	-1.45735	-1.32678	-1.48429	-1.29755	-1.10268
Skewness	-0.45616	-0.50599	-0.21864	0.23867	0.12838	-0.29219	-0.37432	-0.33212	-0.36299	-0.41060	-0.52517	-0.30084	-0.45238	-0.12275

Fig 11: Age distribution of maternal orphans, RSA 1996

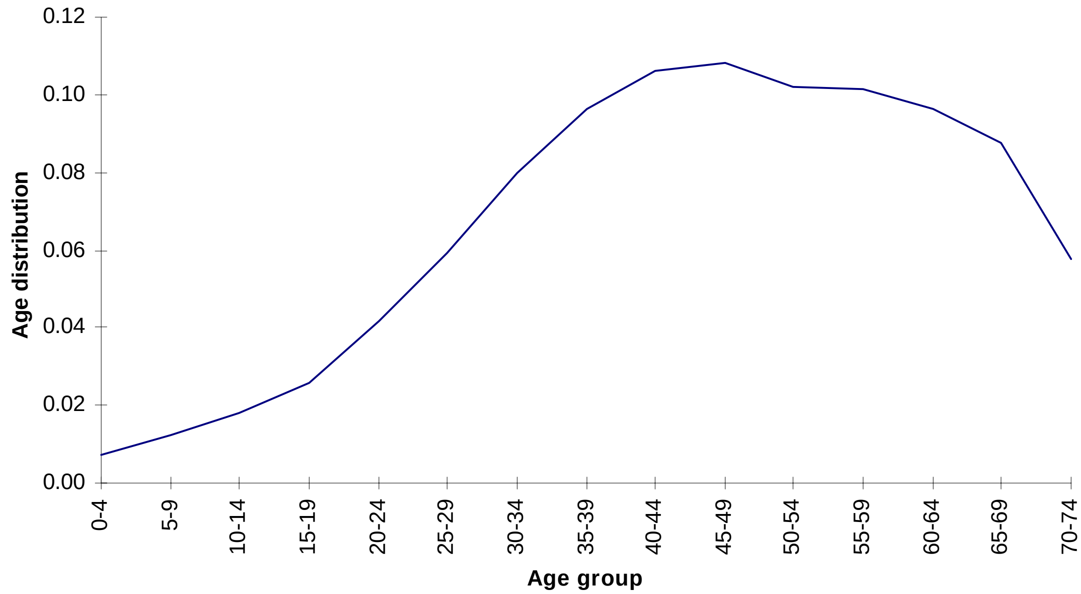


Fig 12: Age distribution of maternal orphans by population group, RSA 1996

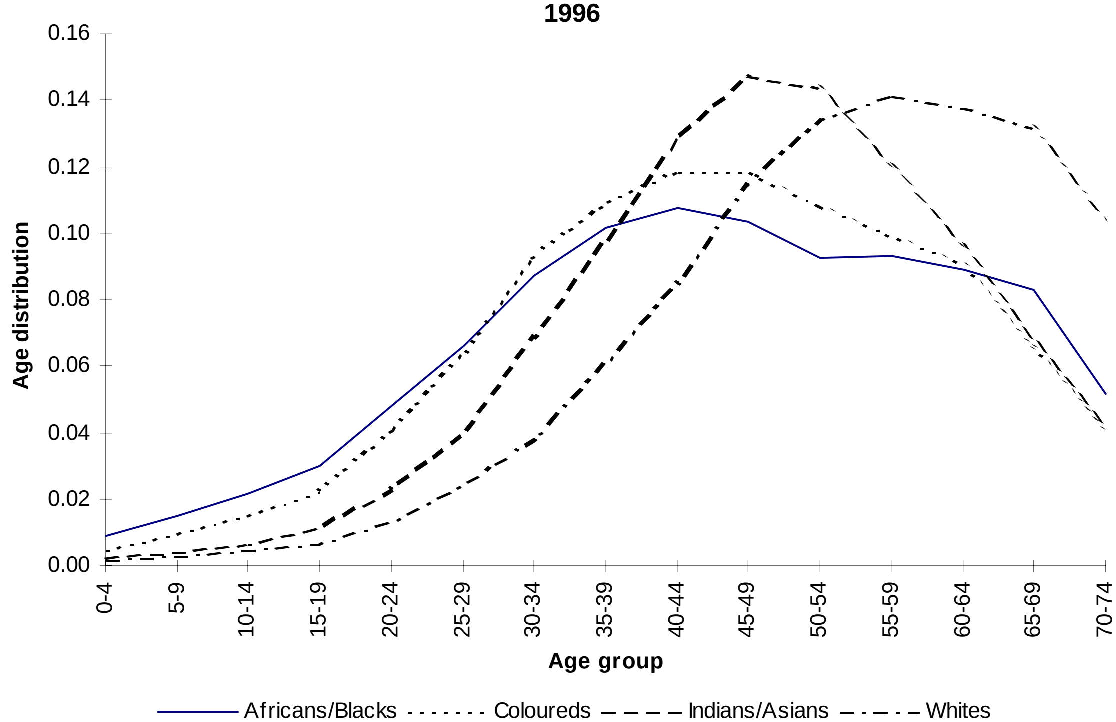


Fig 13: Age distribution of maternal orphans, Eastern Cape, Western Cape and Northern Cape, 1996

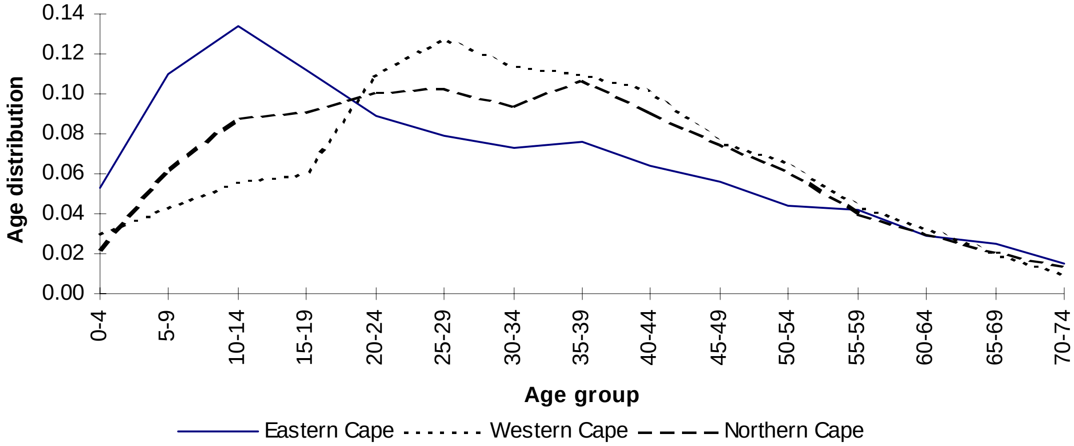


Fig 14: Age distribution of maternal orphans, Free State, KwaZulu-Natal and North West, 1996

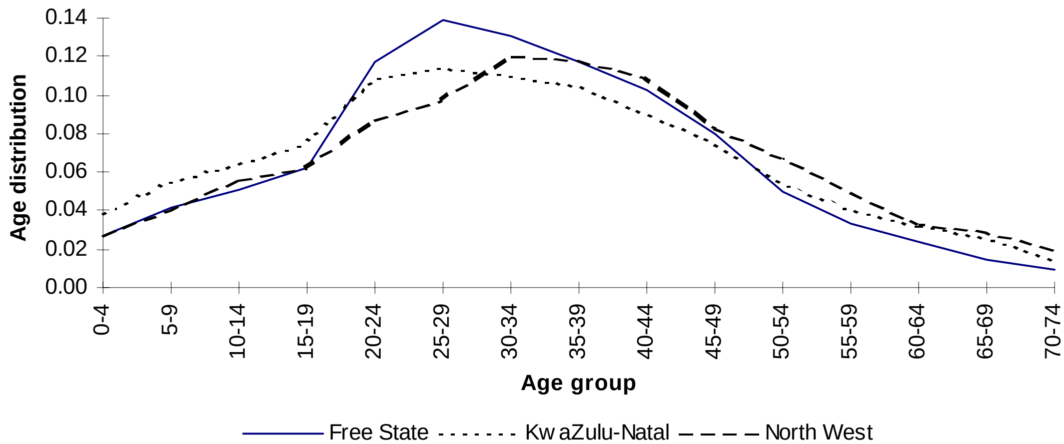
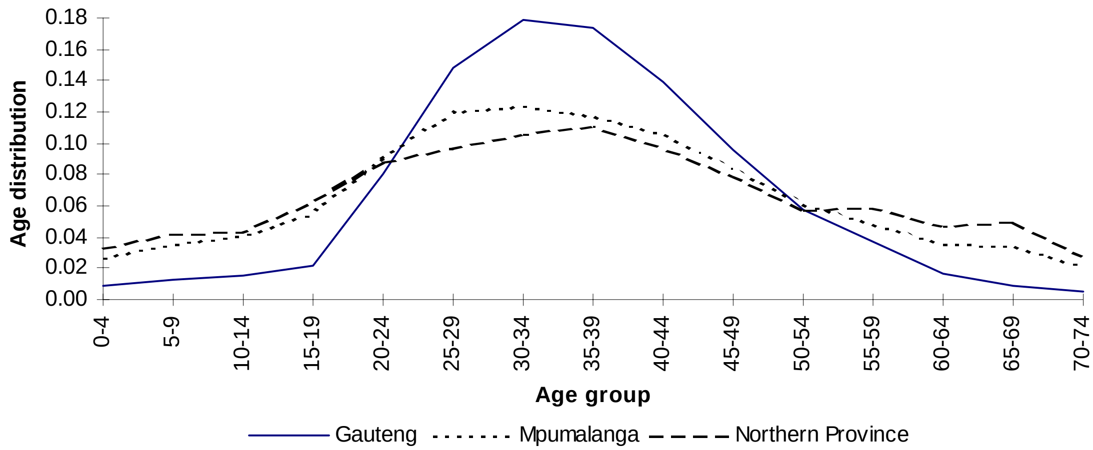


Fig 15: Age distribution of maternal orphans, Gauteng, Mpumalanga and Northern Province, 1996



Age distribution of those who do not know or do not state their maternal orphanhood status

Table 5 gives the proportion of respondents out of all respondents in a given age group who either do not know or did not specify their maternal orphanhood status, P(i.3) and P(i.4). If there are no systematic errors in the data, one would expect that these proportions would be random, without any clear pattern. The standard deviations of the distributions partly reflect this expectation. For further clarity, the P(i.3) and P(i.4) values combined are graphically shown in Figure 16 for the RSA, Figure 17 for the population groups and in Figures 18 through 20 for all the provinces. The P(i.3) and P(i.4) distribution among whites show the least standard deviation (.00058) and the plot of the distribution is close to being flat. Other low standard deviations were those for coloureds (.00074), Indians/Asians (.00078) and Western Cape (.00090). Most of the plots exhibit constant or slightly fluctuating proportions. Marked pattern only comes out in the case of Africans/Blacks, Northern Cape, Northern province and RSA. The pattern that emerges is that of a uni-modal distribution. The proportions increase from about 15-19 and reach a peak at about 35-44 and decline to 60-64, levelling off after age 65. This pattern is less so in the case of Northern Cape.

Table 5: Summary of proportion of respondents out of all respondents in a given age group, who do not know or did not state maternal orphanhood status, RSA, population group and province, 1996

Age group	RSA	African/ Black	Coloured	Indian/ Asian	White	E.C.	W.C.	N.C.	F.S.	KZN	N.W.	GT	MP	N.P
0-4	0.01220	0.01164	0.00766	0.00751	0.01035	0.00904	0.00972	0.00817	0.00808	0.01372	0.01092	0.01507	0.01450	0.01396
5-9	0.01145	0.01099	0.00771	0.00756	0.01036	0.00873	0.00896	0.00759	0.00791	0.01331	0.00954	0.01460	0.01352	0.01268
10-14	0.01102	0.01054	0.00798	0.00735	0.01089	0.00836	0.00848	0.00818	0.00749	0.01279	0.00904	0.01446	0.01274	0.01237
15-19	0.01109	0.01087	0.00786	0.00706	0.01010	0.00785	0.00836	0.00863	0.00815	0.01292	0.00840	0.01527	0.01310	0.01203
20-24	0.01323	0.01376	0.00844	0.00532	0.00948	0.00792	0.00875	0.00905	0.01081	0.01357	0.00911	0.02134	0.01402	0.01335
25-29	0.01554	0.01704	0.00788	0.00523	0.00980	0.00791	0.00894	0.00910	0.01259	0.01385	0.00924	0.02755	0.01522	0.01502
30-34	0.01677	0.01885	0.00786	0.00555	0.00994	0.00742	0.00839	0.00994	0.01221	0.01371	0.00993	0.03300	0.01570	0.01571
35-39	0.01812	0.02076	0.00869	0.00614	0.01021	0.00781	0.00864	0.01299	0.01258	0.01402	0.01067	0.03657	0.01698	0.01743
40-44	0.01848	0.02145	0.00964	0.00650	0.01041	0.00760	0.00929	0.01368	0.01277	0.01438	0.01146	0.03668	0.01755	0.01938
45-49	0.01768	0.02094	0.00964	0.00558	0.00995	0.00783	0.00891	0.01223	0.01346	0.01446	0.01193	0.03354	0.01921	0.01903
50-54	0.01630	0.01912	0.00988	0.00589	0.01030	0.00744	0.00991	0.01191	0.01190	0.01384	0.01233	0.02869	0.02011	0.01907
55-59	0.01505	0.01721	0.00843	0.00631	0.01036	0.00755	0.00829	0.00888	0.01138	0.01394	0.01180	0.02617	0.01855	0.01975
60-64	0.01272	0.01399	0.00790	0.00595	0.01002	0.00667	0.00784	0.00852	0.01089	0.01281	0.01044	0.01943	0.01806	0.01838
65-69	0.01232	0.01336	0.00767	0.00687	0.00913	0.00697	0.00748	0.00837	0.00848	0.01317	0.01070	0.01591	0.01896	0.01849
70-74	0.01171	0.01299	0.00806	0.00709	0.00842	0.00710	0.00605	0.00773	0.00831	0.01183	0.01059	0.01582	0.02019	0.01776
Standard deviation	0.00263	0.00383	0.00074	0.00078	0.00058	0.00061	0.00090	0.00194	0.00207	0.00067	0.00114	0.00826	0.00251	0.00273

Fig 16: Proportion of 'DK and NS' out of all respondents in given age groups, RSA 1996

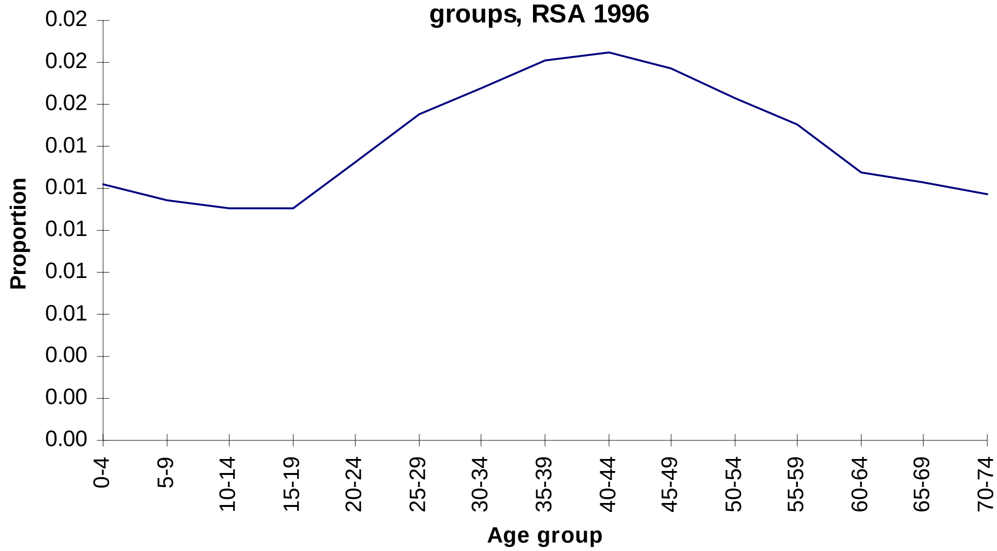


Fig 17: Proportion'DK and NS' out of all respondents in given age groups by population group, RSA 1996

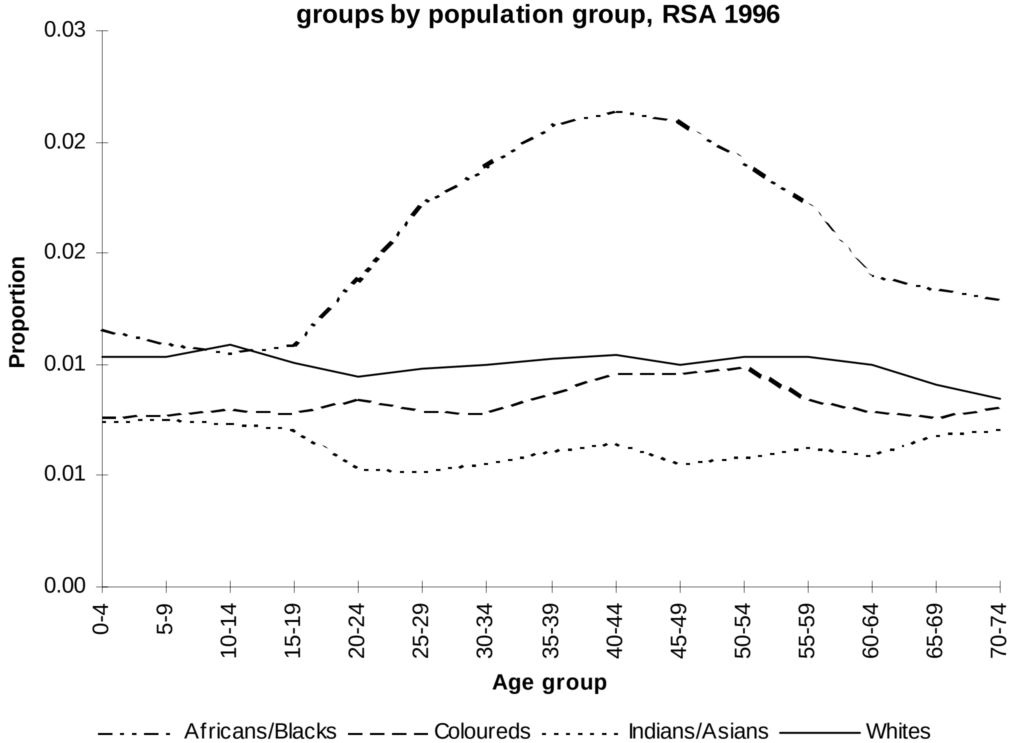


Fig 18: Proprtion of 'DK and NS' out of all respondents in given age groups, Eastern Cape, Western cape and Northern Cape, 1996

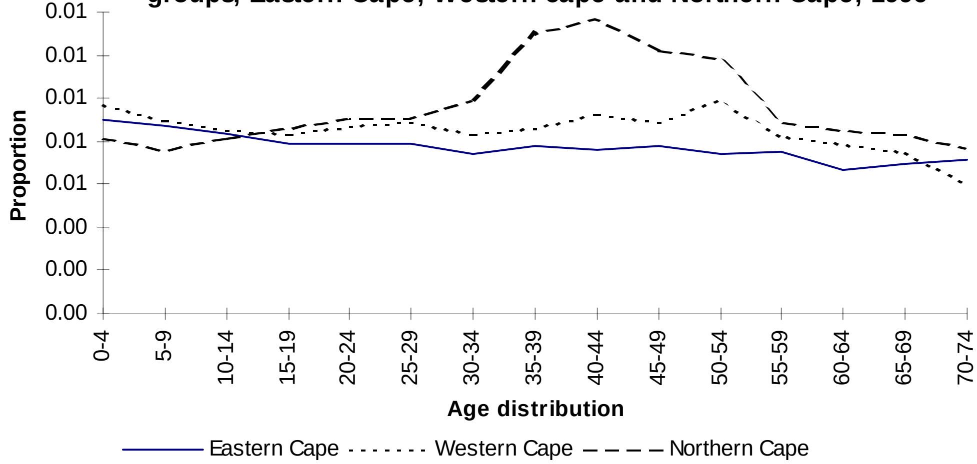


Fig 19: Proportion of 'DK and NS' out of all respondents in given age groups, Free State, KwaZulu-Natal and North West, 1996

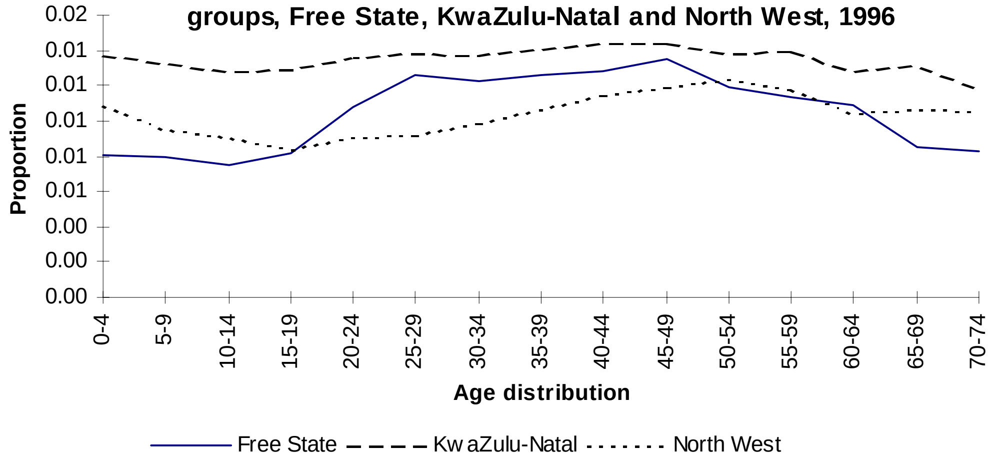
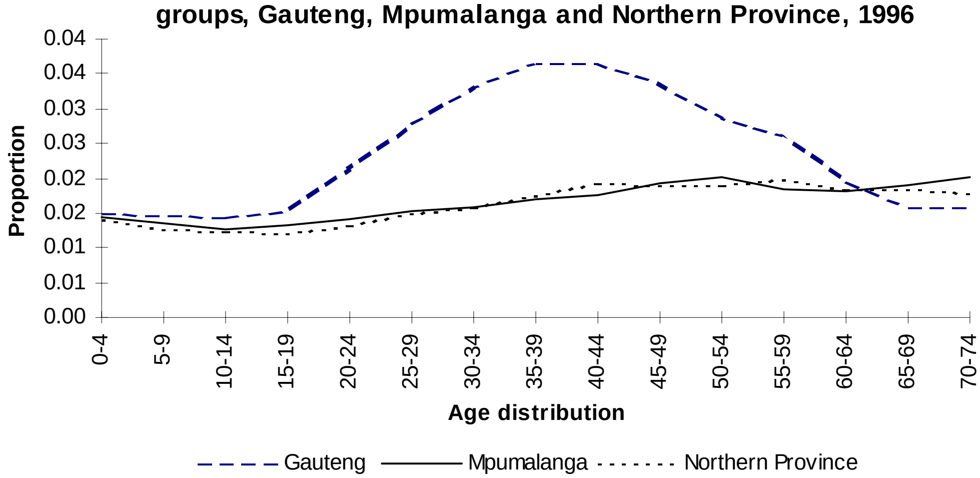


Fig 20: Proportion of 'DK and NS' out of all respondents in given age groups, Gauteng, Mpumalanga and Northern Province, 1996



3. Results of diagnostics on estimates of female adult mortality.

The results of the maternal orphanhood method is shown in Table 6 and the trends in l(45)/l(25) are shown in Figures 21a through 36a, for the cases wherein 'DK' and 'NS' were excluded in the totals and in Figures 21b through 36b, for the cases wherein 'DK' and 'NS' were included in the totals. The typical J-shape of trends in orphanhood estimates has been commented upon by Hill (1984). This J-shape is exhibited by the orphanhood points from the data of the Free State, Gauteng, Mpumalanga, RSA, urbanites, non-urbanites, Africans/blacks, Northern Cape and North West. In the case of Indians/Asians, the trend follow a logistic curve while in the case of data of Northern Cape, Eastern Cape and KwaZulu-Natal and coloureds, the trend is a linear one. For the case of whites the orphanhood points show a poor fit while in the case of Northern Province, the trend imply increasing adult mortality over time.

Based on the trend of the orphanhood points, linear regression equation were fitted on the first 3 points. The intercept *c* and the slope, *m* are given and these were used to obtain a marginal extrapolation of l(45)/l(25) for mid-1990. Since in the case of whites there was no trend in the data, the application of the linear regression equation would be inappropriate.

Table 6: Summary of trend in implied l(45)/l(25) (for females) values based on Brass method, 1990.5

	(excluding NA, DK and NS in totals)			(excluding NA)		
	Solpe *M*	Intercept	l(45)/l(25) 1990.5	Solpe *M*	Intercept	l(45)/l(25) 1990.5
RSA	0.00295	-4.90005	0.96238	0.00232	-3.67303	0.95057
Urban	0.00342	-5.85027	0.96434	0.00258	-4.18307	0.95166
Non urban	0.00296	-4.93301	0.96193	0.00218	-3.39539	0.94982
Population Group						
African/Black	0.00365	-6.30104	0.96175	0.00342	-5.85575	0.95130
Coloured	0.00593	-10.83392	0.96376	0.00459	-8.17904	0.95273
Indian/Asian	0.00263	-4.25933	0.97986	0.00090	-0.82536	0.96936
White	**	**	**	**	**	**
Province						
Eastern Cape	0.00433	-7.66585	0.96021	0.00323	-5.47860	0.95018
Western Cape	0.00412	-7.23822	0.97064	0.00285	-4.71612	0.95934
Northern Cape	0.00354	-6.10724	0.94358	0.00241	-3.86875	0.93252
Free State	0.00424	-7.47215	0.96118	0.00403	-7.06362	0.95277
KwaZulu-Natal	0.00322	-5.45356	0.96168	0.00135	-1.73899	0.94488
North West	0.00310	-5.21450	0.96269	0.00192	-2.86571	0.95182
Gauteng	0.00380	-6.60241	0.96697	0.00408	-7.16617	0.95297
Mpumalanga	0.00332	-5.63388	0.96476	0.00190	-2.83516	0.94932
Northern Province	-0.00064	2.23291	0.96107	-0.00212	5.16673	0.94627

** - poor fit

Fig 21a: Trend in l(45)/l(25) among RSA females (excluding NA, DK and NS in totals)

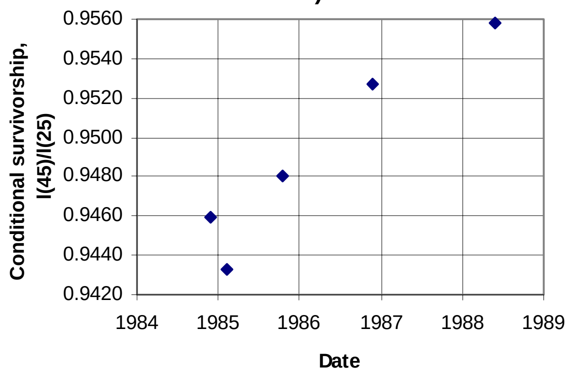


Fig 21b: Trend in l(45)/l(25) among RSA females (excluding NA)

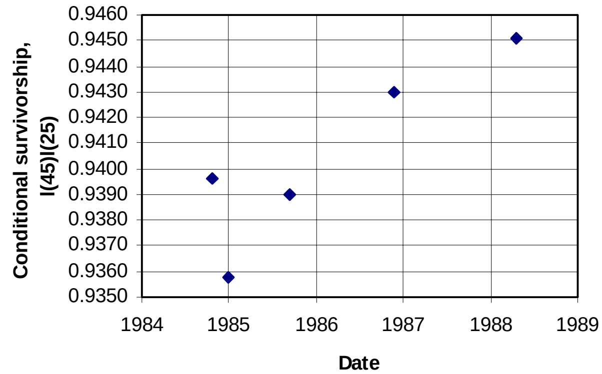


Fig 22a: Trend in l(45)/l(25) among RSA urban females (excluding NA, DK and NS in totals)

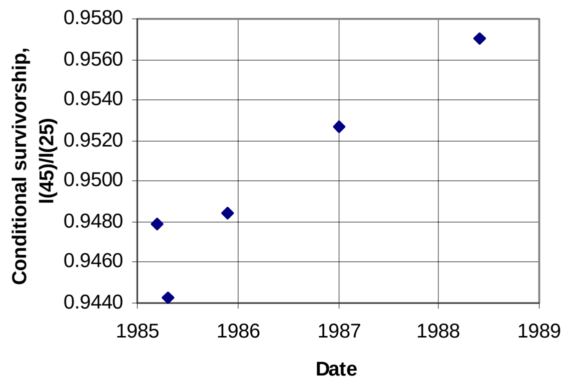


Fig 22b: Trend in l(45)/l(25) among RSA urban females (excluding NA)

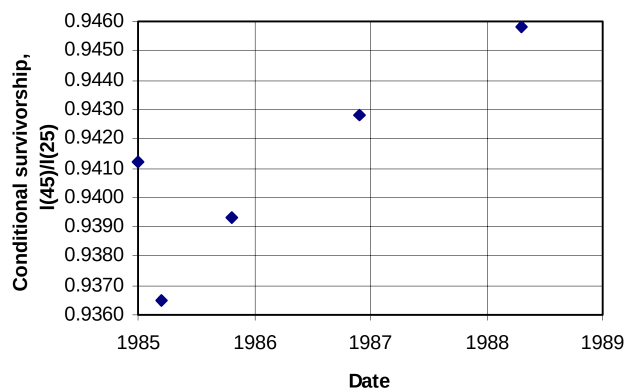


Fig 23a: Trend in l(45)/l(25) among RSA non-urban females (excluding NA, DK and NS in totals)

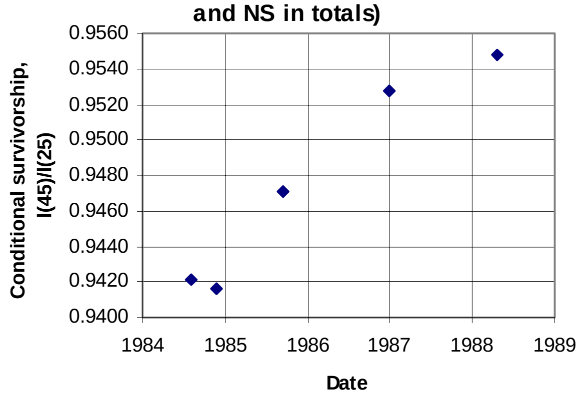
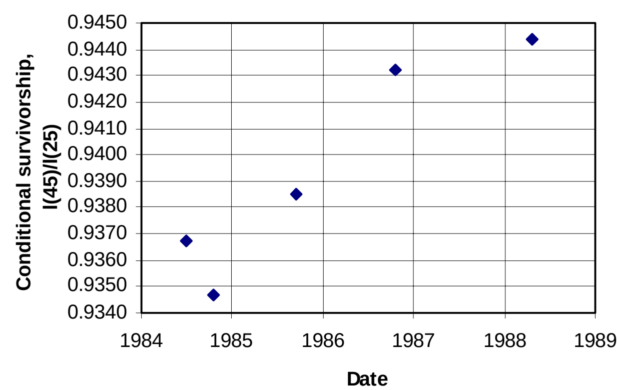


Fig 23b: Trend in l(45)/l(25) among RSA non-urban females (excluding NA)



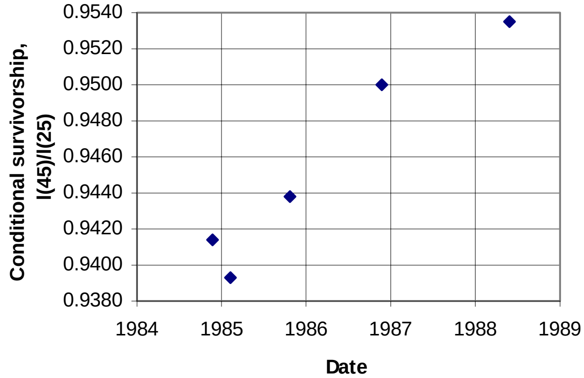


Fig 24a: Trend in l(45)/l(25) among RSA Africans/Blacks females 1996 (excluding NA, DK and NS in totals)

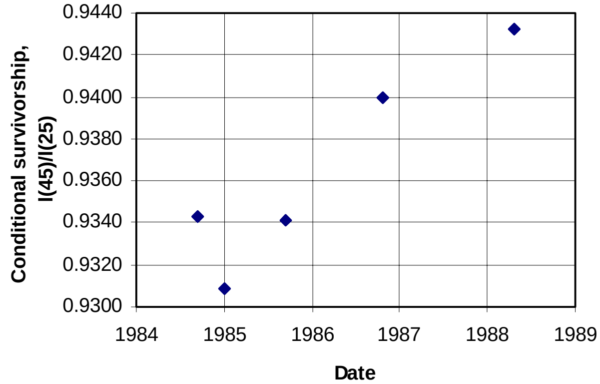


Fig 24b: Trend in l(45)/l(25) among RSA Africans/Blacks females 1996 (excluding NA)

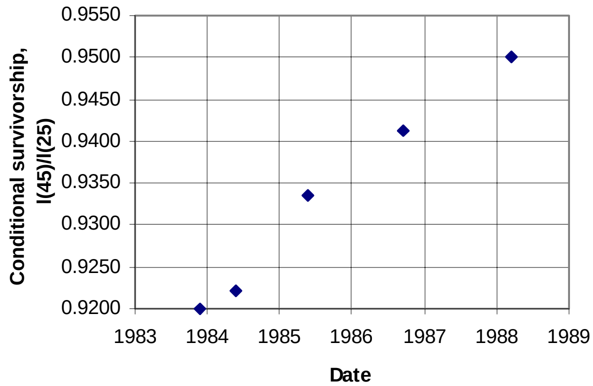


Fig 25a: Trend in l(45)/l(25) among RSA Coloured females (excluding NA, DK and NS in totals)

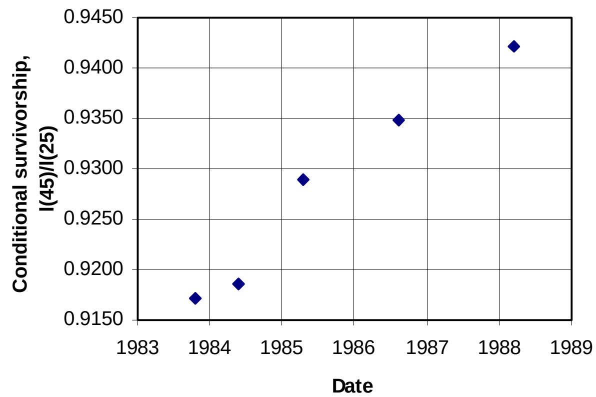


Fig 25b: Trend in l(45)/l(25) among RSA female Coloureds (excluding NA)

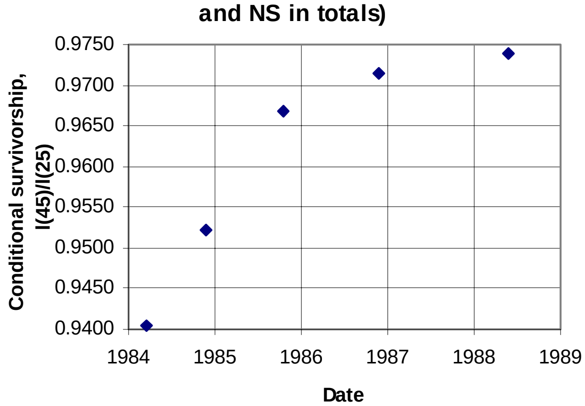


Fig 26a: Trend in l(45)/l(25) among RSA Asian/Indian females (excluding NA, DK and NS in totals)

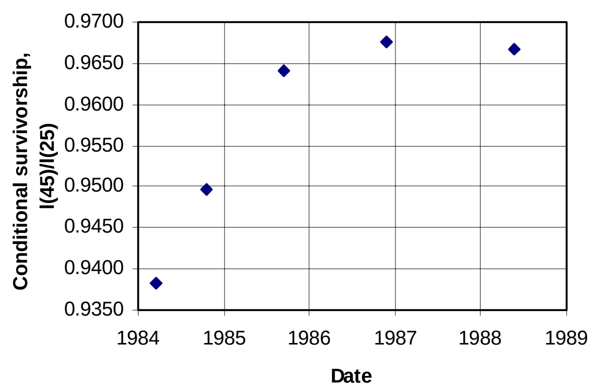


Fig 26b: Trend in l(45)/l(25) among RSA Asian/Indian females (excluding NA)

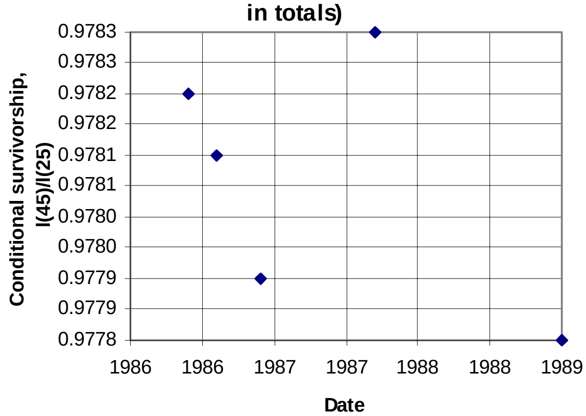


Fig 27a: Trend in l(45)/l(25) among RSA White female (excluding NA, DK and NS in totals)

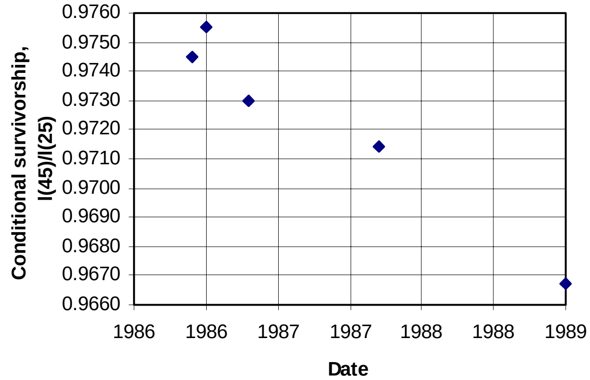


Fig 27b: Trend in l(45)/l(25) among RSA White female (excluding NA)

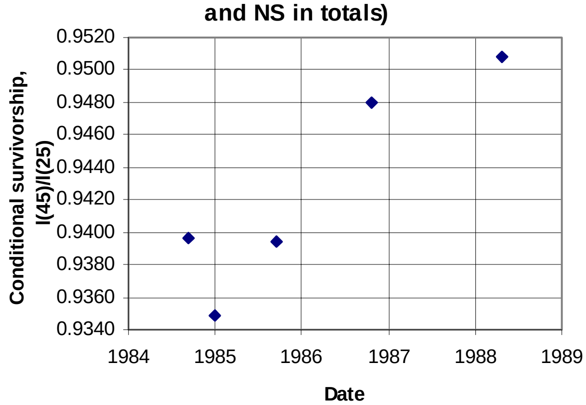


Fig 28a: Trend in l(45)/l(25) among female residents of Free State (excluding NA, DK and NS in totals)

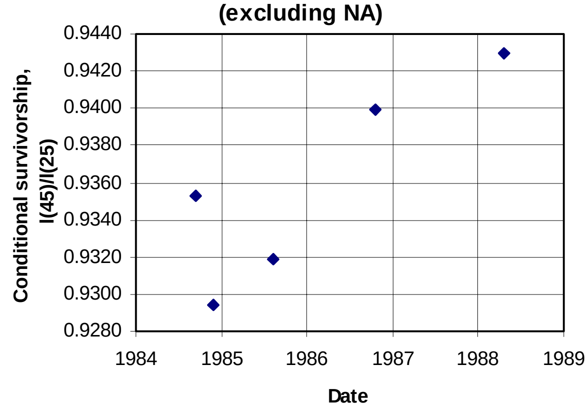


Fig 28b: Trend in l(45)/l(25) among female residents of Free State (excluding NA)

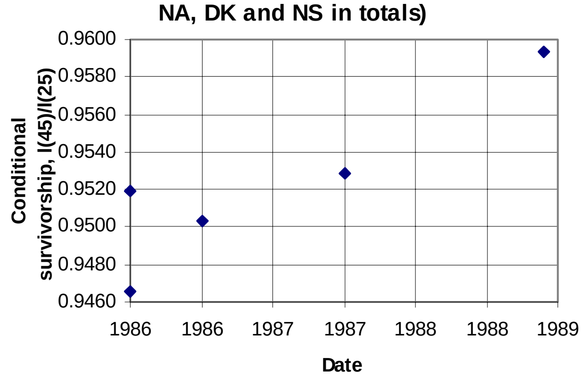


Fig 29a: Trend in l(45)/l(25) among female residents of Gauteng (excluding NA, DK and NS in totals)

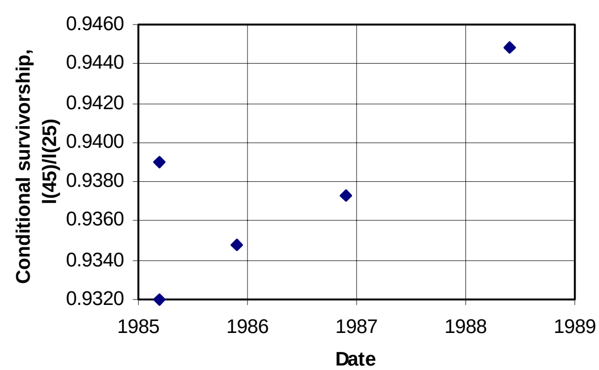


Fig 29b: Trend in l(45)/l(25) among female residents of Gauteng (excluding NA)

Fig 30a: Trend in l(45)/l(25) among female residents of Mpumalanga (excluding NA, DK and NS in totals)

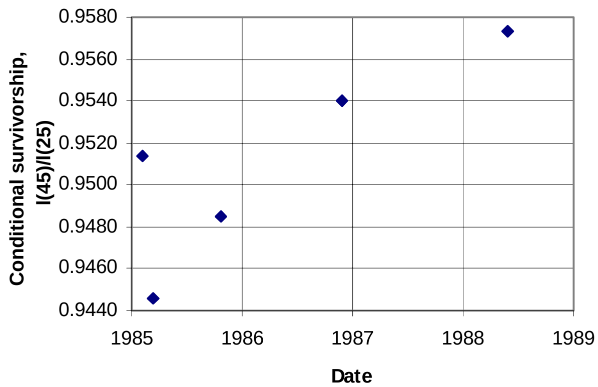


Fig 30b: Trend in l(45)/l(25) among female residents fo Mpumalanga (excluding NA)

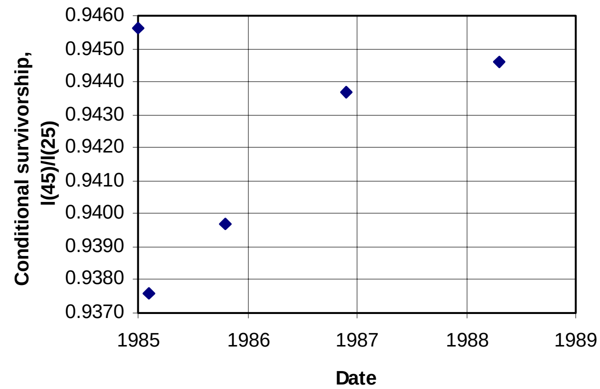


Fig 31a: Trend in l(45)/l(25) among female residents of Northern Cape (excluding NA, DK and NS in totals)

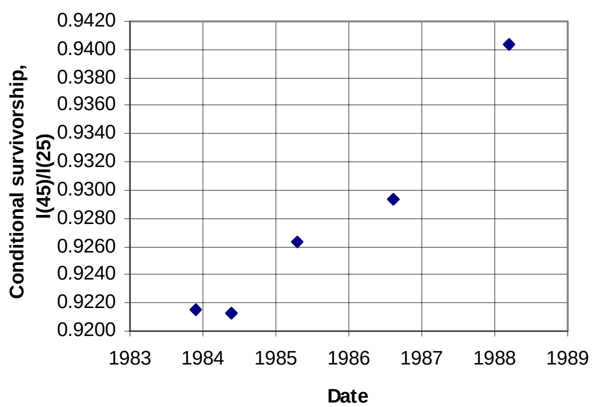


Fig 31b: Trend in l(45)/l(25) among female residents of Northern Cape (excluding NA)

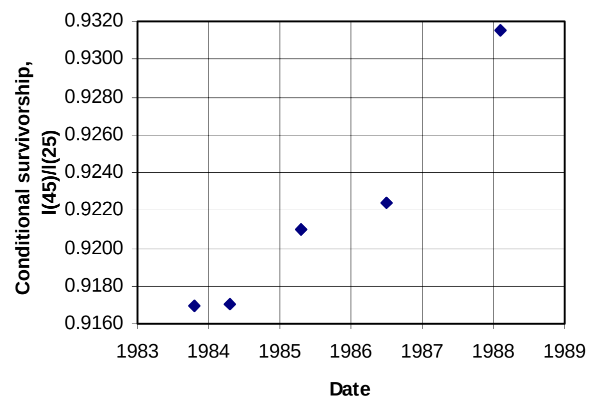


Fig 32a: Trend in l(45)/l(25) among female residents of Eastern Cape (excluding NA, DK and NS in totals)

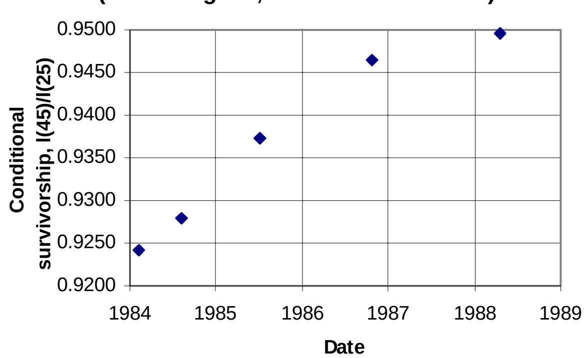


Fig 32b: Trend in l(45)/l(25) among female residents of Eastern Cape (excluding NA)

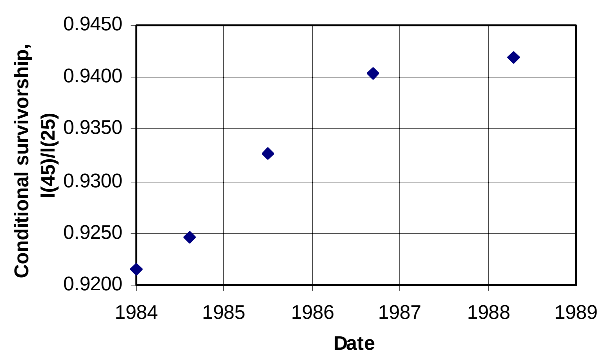


Fig 33a: Trend in l(45)/l(25) among female residents of Western Cape (excluding NA, DK and NS in totals)

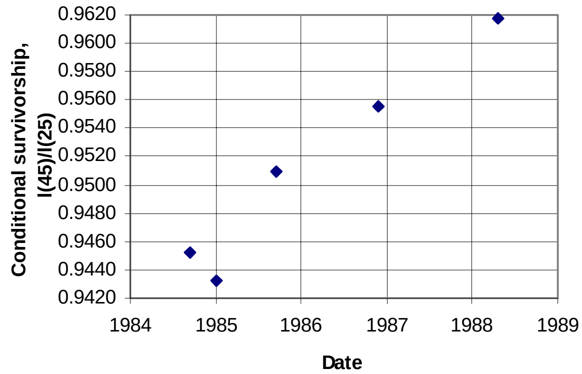


Fig 33b: Trend in l(45)/l(25) among female residents of Western Cape (excluding NA)

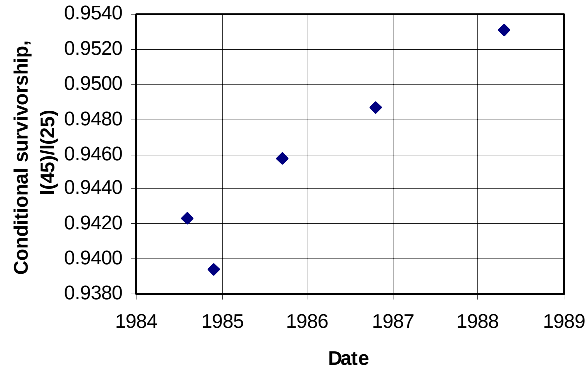


Fig 34a: Trend in l(45)/l(25) among female residents of North West (excluding NA, DK and NS in totals)

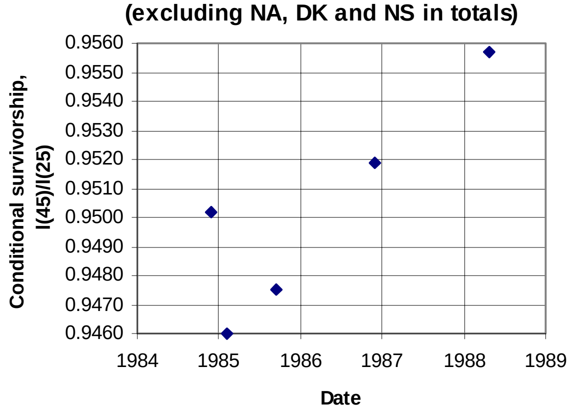


Fig 34b: Trend in l(45)/l(25) among female residents of North West (excluding NA)

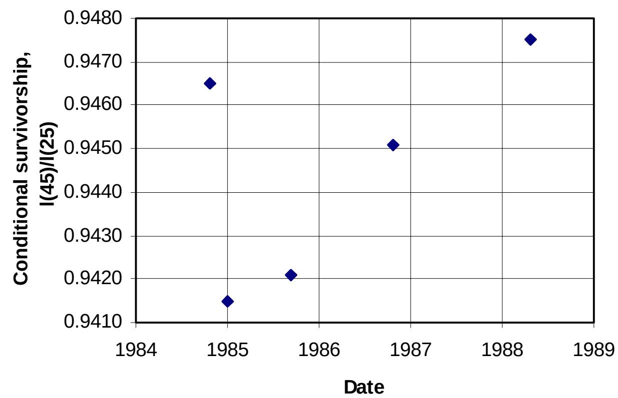


Fig 35a: Trend in l(45)/l(25) among female residents of KwaZulu Natal (excluding NA, DK and NS in totals)

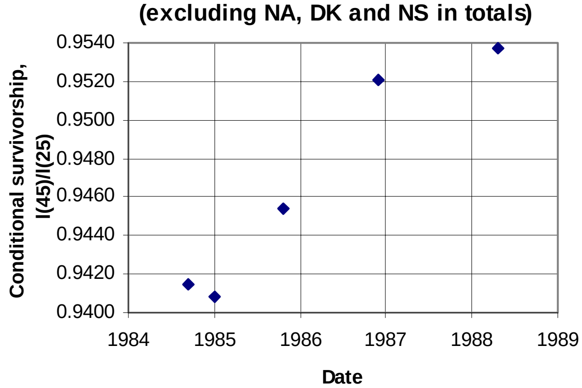
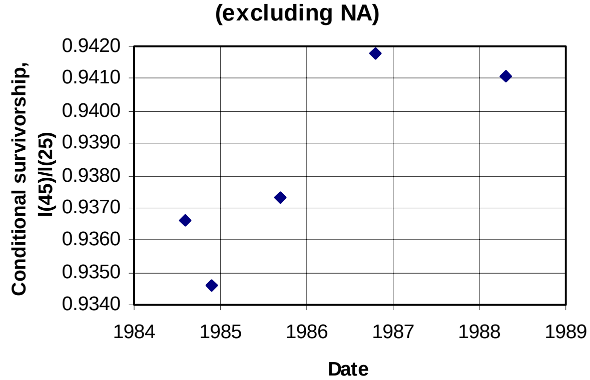
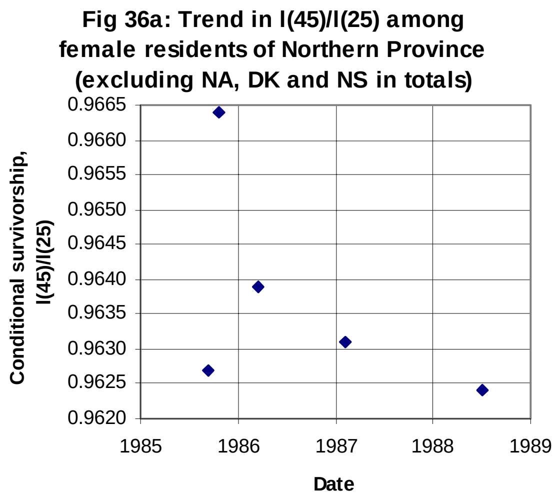
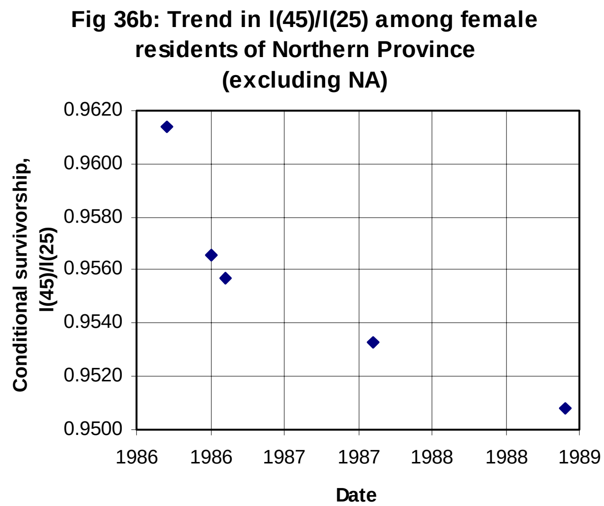


Fig 35b: Trend in l(45)/l(25) among female residents of KwaZulu Natal (excluding NA)







Discussion

Based on the analysis of single year age and sex data, it can be seen that the age reporting in the South African census has been very good. From the census results of many African countries, it is rare to find values of values of Whipple's index below 110, values of Myer's Index below 5 and values of Joint Score below 20. The fact that the age variable was derived from the information on date of birth has been a strong factor in ensuring accurate age reporting.

The age distribution by population group show marked difference in the age structures. Whites have the smallest proportion of their population under 30 and the highest proportion for ages over 40. This is one of the characteristic of an ageing population. The age distribution which closely follows this pattern is that of Indians/Asians. However, the proportion of Indians/Asians above age 65 is quite low. Africans/blacks comprise the youngest population with highest proportion under 30 and lowest proportion beyond age 30. This profile of age structure is largely reflected in the reported proportion of maternal orphans out all respondents in a given age group. The proportions show that the ageing populations as having less proportion orphaned in the younger ages and increasingly higher proportion in the older ages. Conversely, the younger population have higher proportions in the younger ages and decreasing proportions with increase in age. This population structure is also reflected in the age distribution of maternal orphans. For the ageing population, one can see a positively skewed distribution towards higher ages with higher peaks while for the younger populations, one can see a less positively skewed distribution with lower peak.

For the provinces, most of the age distributions appear normal except for Eastern Cape, Gauteng and Northern Province. In Eastern Cape and Northern Province, there is a higher than average proportion under age 20 and lower than average proportion beyond age 20. For Gauteng, there is a marked deficit of population under 20 and higher proportion in the adult working ages of 20-55. For Eastern Cape and Northern Province, the higher than average proportion under 20 is not reflected in the proportion of maternal orphans in that age range. The proportion of maternal orphans in that age range is normal and compares well with those for other provinces. Also, for Gauteng, with less than average proportion under 20, the effect is not reflected in the proportions of maternal orphans in that age range. The 'aberrant' young age structure of the Eastern Cape is reflected in the age distribution of maternal orphans which shows a negatively skewed distribution with the highest peak in the age group 10-14. While the age structure of KwaZulu-Natal appears normal, the age distribution of orphans shows a slight increase in the younger ages and a slight negative skewness in the distribution. For both Eastern Cape and KwaZulu-Natal, this age distribution suggests either the presence of 'AIDS orphans' or a manifestation of the adoption effect. In addition, the Eastern Cape has historically been a province of high out-migration as the province used to serve as a labour reserve for the mines in the Free State. The high proportion of children in this province could possibly only be reflecting the large relative absence of adults who had left the province. For Northern Province however, the effect of the aberrant young age structure is not reflected in the age distribution of maternal orphans. For Gauteng, the effect of the age structure comes out on the age distribution of maternal orphans as reflected in the deficit in orphans below 20 and a peak in the age distribution of orphans centring around the prime working ages of 30-39.

The phenomenon of those who do not know or did not state their maternal orphanhood status , 'DK and NS', is a totally different one. While all the distributions show roughly linear trend, an unexpected systematic pattern emerges in the case of Africans/blacks, Northern Cape and Gauteng and to some extent for the Free State. For the first three distributions, the age group for which the proportions of DK and NS peaked is in the age group 40-44. These are survivors of the 1955-59 birth cohort. It must be noted that the 1950's saw the enactment of several Acts and bills which served as against the interests of majority of the population. Two such examples are the Population Registration Act of 1950 and the Native Laws Amendment Bill of 1951. It is possible through the enforcement of such laws and other similar ones, a large number of adults (parents of the 1950-59 cohort) were 'made to disappear' and as such, when the children of that birth cohort came of age, they would not know about the survivorship status of their parents. To the extent that this is true, the effect should be more pronounced in the paternal orphanhood data than in the maternal orphanhood data. In a few instances, the variances between the mortality estimates obtained with and without the inclusion of 'DK and NS' in the total could be attributed to the systematic pattern in the age distribution of DK and NS. This is the case for Africans/blacks, Northern Cape and Gauteng. In other instances, there is variance in the mortality estimates even though the proportions of DK and NS show a normal trend. This is the case of KwaZulu-Natal and Mpumalanga.

In discussing about the trend in the adult mortality estimates and whether the trend is plausible or not, one is confronted with the problem of appropriate choice of points. Which points to use in the calculation of the regression equation? Points 1 to 3 or points 1 to 4, or points 2 to 4 all give different values. As points 1 to 3 have been used consistently throughout the analysis, the results could be compared without loss of generality.

The summary of the diagnostics is presented in Table 7 using fairly simple ranking of 1 to 3. For describing trends and the quality of age reporting, 1 represents good, 2, fair and 3- poor For describing normality in age distribution and distributions of D(i,j), P(i,j) and 'DK and NS', 1 presents normal, 2 slightly abnormal and 3 very much abnormal. The mortality trend with 'DK and NS' excluded in the totals is ranked separately from the one in which 'DK and NS' was included in the totals. The table shows whites, coloureds and Indians/Asians as performing best in the diagnostics but with whites and Indians/Asians coming out the worst in the plausibility of the adult mortality trends. On the contrary, Eastern Cape comes out worst in the diagnostics but showing plausible trends in adult mortality.

The reason why the worst trends were obtained for whites and Indians/Asians while they had the best diagnostics has probably to do with the model itself. The model which was initially meant for use in high mortality and young populations is probably not suitable for application in low mortality and ageing populations. There is probably a need for developing alternative models which take these and other factors into account. The incomplete gamma function was fitted to the different age distributions of maternal orphans and the fit was found to be quite good. Further details are given in the Appendix. It is possible that a new approach to modelling adult mortality could be explored using the incomplete gamma distribution as the basis.

Table 7: Summary of Diagnostics

	Diagnostics						**Outcome**		
	Age distribution	Age reporting	P(i,j)	D(i,j)	'DK+NS'	Total	Trend (x DK+NS)	Trend (inc DK+NS)	Total
RSA	1	1	1	1	3	7	2	2	4
Africans/Blacks	1	2	1	1	3	7	1	1	2
Asians/Indians	1	1	1	1	1	5	3	3	6
Coloureds	1	1	1	1	1	5	1	2	3
Whites	1	1	1	1	1	5	3	3	6
Western Cape	1	1	1	1	1	5	2	2	4
Northern Cape	1	1	1	1	3	7	3	3	6
Eastern Cape	3	1	1	3	1	9	1	2	3
Gauteng	3	1	1	1	3	9	3	3	6
Mpumalanga	1	1	1	1	1	5	2	3	5
Northern Province	2	1	1	1	1	6	3	3	6
KwaZulu Natal	1	1	1	2	1	6	2	3	5
North West	1	1	1	1	1	5	2	2	4
Free State	1	1	1	1	2	6	2	2	4

Key for age distribution, D(i,j), P(i,j), 'DK+NS'
- 1 = Normal
- 2 = Slightly abnormal
- 3 = Very much abnormal

Key for trends, age reporting
- 1 = Good
- 2 = Medium
- 3 = Poor

Conclusion

The distribution of proportions with mother alive (complement of maternal orphans) in given age groups is the main input in the estimation of female adult mortality through the orphanhood method. This paper has shown that the distribution of maternal orphans is normal for all the population sub-groups studied. However, the trend in adult mortality do not exhibit plausible trend in all cases. For such population subgroups, diagnostics are needed to find out the causes for the implausibility of the trends in the estimates.

The diagnostics attempted in this paper have shown that among the factors that affect the estimates of maternal orphanhood, the one with the least effect on the mortality estimates is age misreporting. The age analysis show very good age reporting for all population groups and all provinces. The next factor with less effect on the mortality estimates is that of ‘adoption effect’. In this case it is hard to distinguish ‘adoption effect’ from ‘AIDS orphans’ effect. This adoption/AIDS orphans effect is more pronounced in Eastern Cape and Northern Cape.

The two factors which show large effect in the trend in mortality estimates is the age distribution of maternal orphans and the proportion of DK and NS. For several of the estimates, extrapolation to 1999 based on the regression parameters would yield improbable conditional probabilities greater than 1.00. One would therefore like to reiterate the conclusion that Hill(1984:172) had reached earlier.

> “The use of the maternal survival data to estimate recent trends in mortality, or to reconstruct the recent trend in mortality is doomed to failure, but the general level of mortality for a period 10 or 15 years before the survey may be acceptable in the absence of a better basis for estimation”

The paper has shown that while the maternal orphanhood data is good, unique factors related to South African history have contributed to raising the proportion of DK and NS in the data. Current dynamics is contributing to raising the number of AIDS orphans. Ironically, to the maternal orphanhood method, AIDS orphans would seem as ‘adoption effect’ and the technique assumes the absence of the adoption effect in the data.

In summary, poor female adult mortality estimates based on indirect estimation techniques do not necessarily mean that the quality of the South African census data is bad. It could be due to one of several factors including the effect of ageing/low mortality, AIDS orphans and the large proportion of those who, for historical reasons, do not know about their maternal orphanhood status. All these affect the model used in the estimation of adult mortality.

The methodological implication of this work is that it opens up the possibility of developing an adult mortality model using a different approach. Firstly, for a standard population, relationship has to be established between P(i.2) (or summary measures that capture it) and the parameter ‘*a*’ of the incomplete gamma function. Secondly, the value of ‘*a*’ would then be refined based on the values of skewness and kurtosis obtained for D(i,j) and the standard deviation of ‘DK and NS’. Thirdly, the value of ‘*a*’ would have to translated to adult mortality measure. Once these are in place then for any given population, these measure of central tendency would have to be computed and related to those for the standard population.

Disclaimer

The views expressed in this paper are mine and do not necessarily reflect the view of Statistics South Africa.

Acknowledgement

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Appendix

Fitting the Incomplete Gamma Function on the proportion of maternal orphans out of all respondents in given age groups

During the diagnostics, it was found that the distribution of maternal orphans out of all respondents in a given age groups P(i.2) had close similarity with the incomplete gamma function. Attempt was made to fit that known distribution to the data.

The incomplete gamma function *P(a,x)* is defined as:

$$P(a,x) = \frac{\gamma(a,x)}{\Gamma(a)} = \frac{1}{\Gamma(a)}\int_0^x e^{-t} t^{a-1} dt \text{ where a >0}$$

where Γ(a) is defined as:

$$\Gamma(a) = \int_0^\infty e^{-t} t^{a-1} dt \text{ (Press, W. } \textit{et al.} \text{ .1992)}$$

Upon comparing the P(i.2) values with different values of *a* in the incomplete gamma function, it was found that the fits were good. The P(i.2) values for coloureds, Indians/Asians and for residents of Eastern Cape fitted the incomplete gamma function with parameter values of *a* = 9.2 and 9.4. The P(i.2) values for residents of Western Cape, Northern Cape, KwaZulu-Natal fitted the incomplete gamma function with parameter values of *a* = 9.4 and 9.6. The P(i.2) values for Africans/blacks, residents of the Free State and RSA as a whole fitted the incomplete gamma function with parameter values of *a* = 9.8 and 10.0. For whites and residents of North West, Gauteng and Mpumalanga, the incomplete gamma function that fitted their P(i.2) values well were those for parameter values of *a* = 10.0 and 10.2. Lastly, for residents of Northern Province, the P(i.2) values were well fitted with the incomplete gamma function for values of *a* = 10.2 and 10.4. These fits are shown in Figures 11 through 15. In general, the IGF fitted better in the adult ages and beyond than in then childhood ages. The poorest fit is for Mpumalanga where the proportions in the childhood ages were relatively high while the proportions in the older ages were relatively low.

Figure A1: Fitting the Incomplete gamma function on P(i,2) values for Coloureds, Indians/Asians, Eastern Cape, 1996

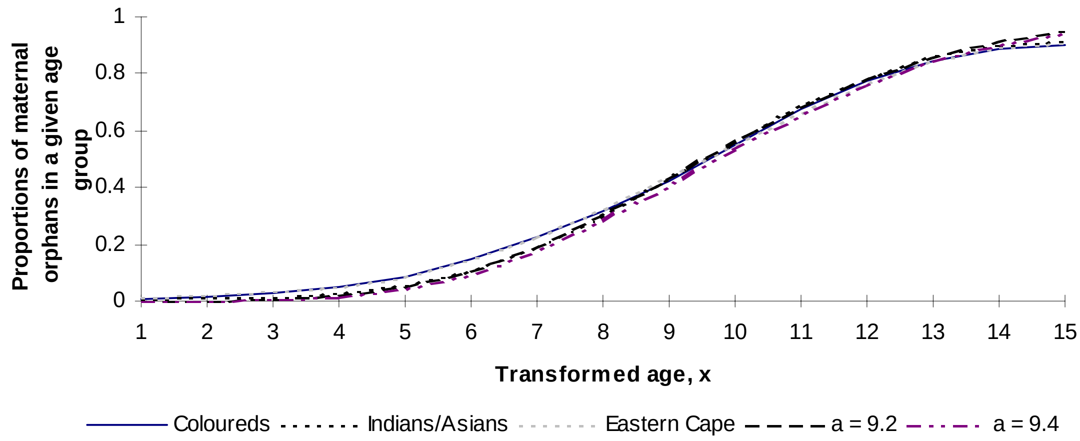

Figure A2: Fitting the Incomplete gamma function on P(i,2) values for Western Cape, Northern Cape and KwaZulu-Natal, 1996

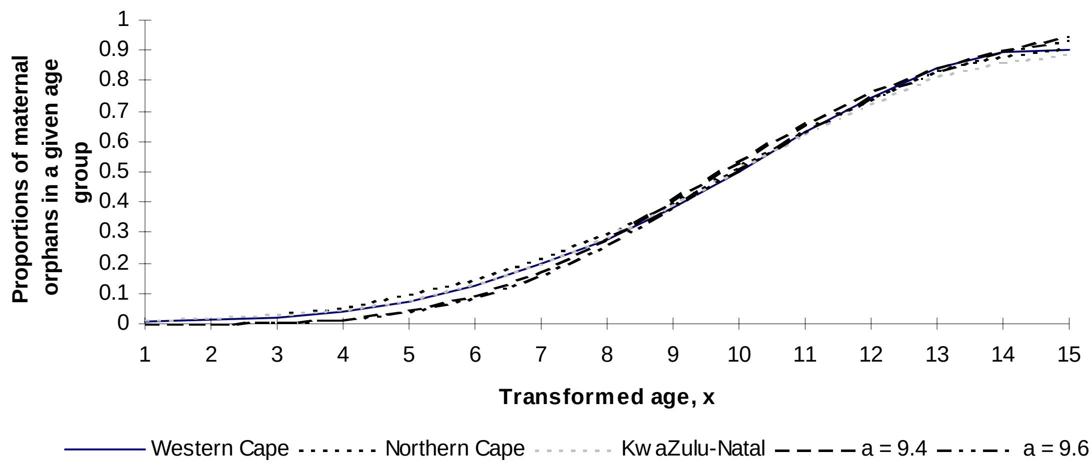

Figure A3: Fitting the Incomplete gamma function on P(i,2) values for RSA, Africans/Blacks and Free State, 1996

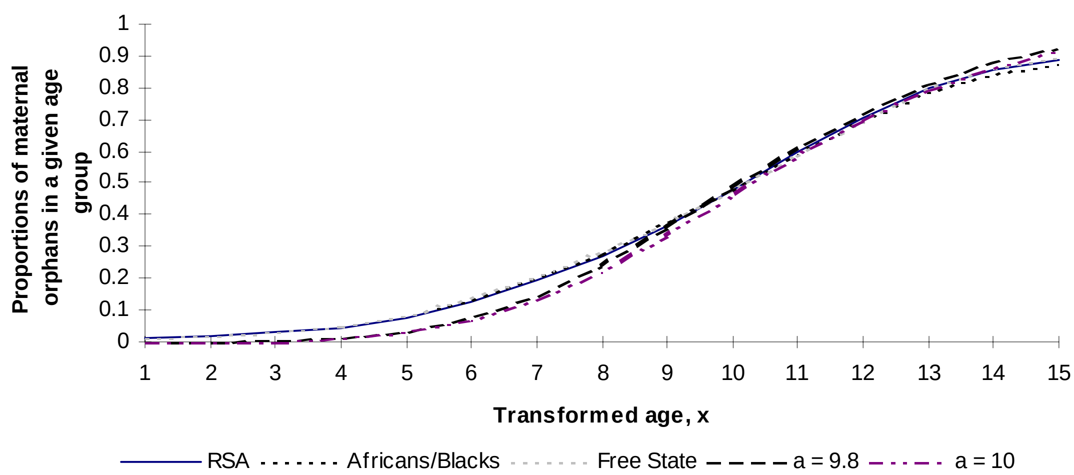

Figure A4: Fitting the Incomplete gamma function on P(i,2) values for Whites, North West, Gauteng and Mpumalanga 1996

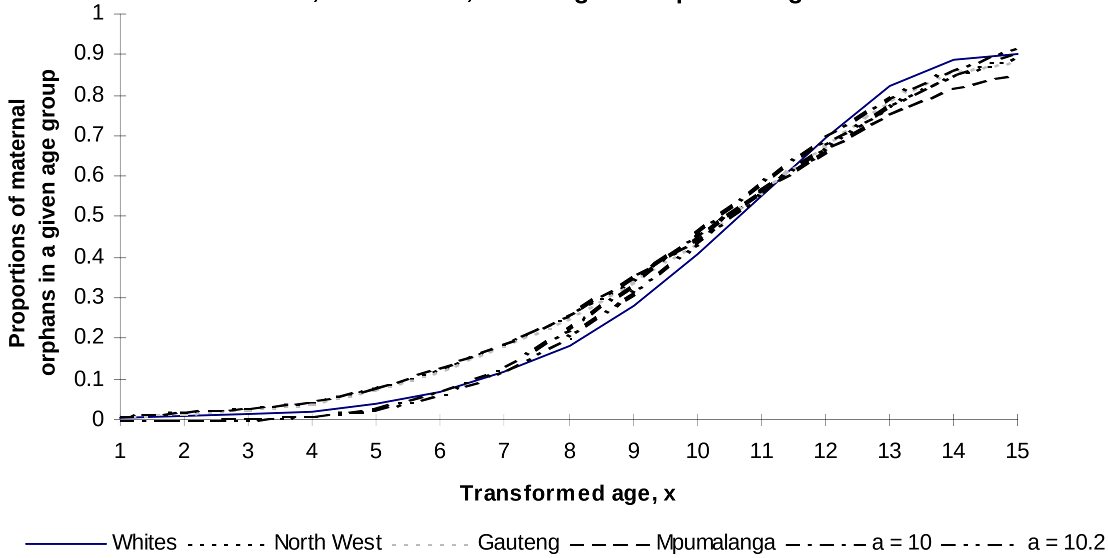

Figure A5: Fitting the Incomplete gamma function on P(i,2) values for Northern Province, 1996